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Member, League of Kansas Municipalities

October 10, 1932.

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Supt. Water Department.

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SEPTEMBER, 1933

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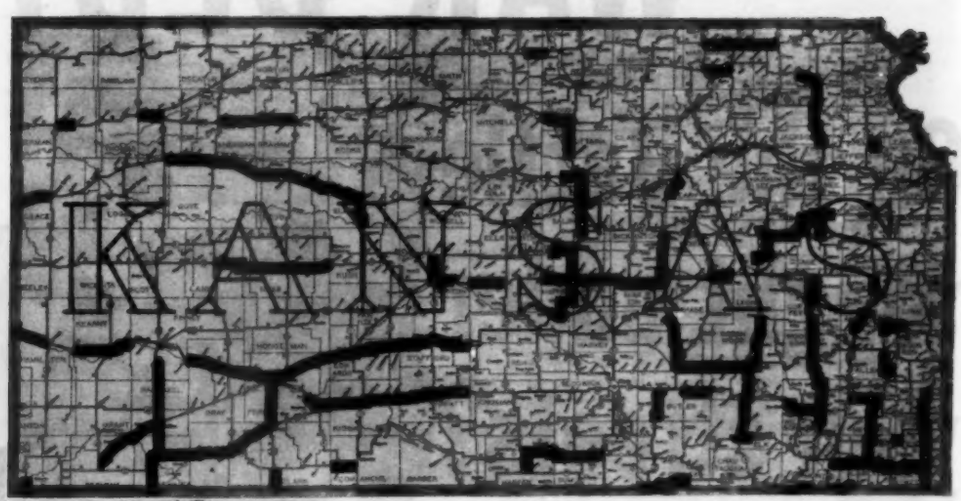
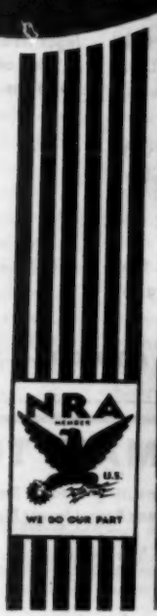
Table of Contents.....7; Industrial Literature.....47; Directory of Consulting Engineers.....43-44; Advertising Index.....50

Kansas Builds Bituminous Roads





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September 1933

PUBLIC WORKS

Vol. 64 No. 9

CITY, COUNTY AND STATE ENGINEERING AND CONSTRUCTION

TABLE OF CONTENTS FOR SEPTEMBER, 1933

Construction:

Getting Competent Contractors for Your Job. *By E. Bender* 9
Road Contractor Gets Repair Part in Record Time 15
Legal Items for the Contractor and Engineer. *By John Simpson* 40

Editorial 17

General:

Drainage in Georgia for Malaria Control 30
Army Preventive for Poison Oak 39

Highways and Pavements:

Cut-Back Asphalt Used for Mixed-in-Place 13
Roadside Weeds Kept Mowed for Safety and Beautification 14
Pre-Mix Resurfacing Both Satisfactory and Cheap. *By W. W. Reeder* 21
California Pavements Records and Construction Progress. *By Earl Withycombe* 25
Solving Hydraulic Problems Necessitated by Highway Location 36
The Trans-Bay Bridge Tunnel 36
Calcium Chloride Highway Patching 38
A Low-Cost Limestone Road in Mississippi 38
Bidders on Ohio Highway Projects Must Prequalify 39
Liability of State for Result of Blasting by Highway Contractor 40

Sewerage and Sewage Treatment:

Non-Odorous, Non-Bacterial Sewage Treatment 10
The DIGESTION TANK. *By A. Prescott Folwell* 16
Cast Iron for Sewer Connections in Maryland 20
Disintegrating Sewage for Ocean Dilution 22
The Sewerage System of Tokyo. *By Isador W. Mendelsohn* 27
Pollution of State Waters by Sewage—a Legal Decision 40
Sewerage Extra Ordered Verbally—a Legal Decision 40

Water Supply and Purification:

Waterworks Reconstruction Financed from Earnings. *By H. F. Wiedeman* 11
Painting Standpipes and Elevated Tanks. *By H. E. Newell* 12
Activated Carbon and Ammonia-Chlorine in Water Purification 12
Iron Removal Plant Paid for from Earnings. *By E. Roy Wells* 18
The WATER WHEEL 23
Improvements in Public Water Supplies in N. Y. State in 1932 28
The Depression and the Water Works 30
Treatment of Flood Contaminated Wells 32
Water Resources Commission of Maryland 32

Departments:

Equipment for the New Deal ..... 41 and 45
Books and Booklets 46
Industrial Literature Section 47

BRAINSTORMS

The Editor of this worthy department, devoted to keeping engineers in mathematical practice during the depression, is away on his vacation. In his absence, his substitute offers a couple of simple little problems that may help to keep *Brainteaser* fans in some sort of practice for the time being. These are all based on the same idea as the simple little problem way back in February, 1932, which read something like this: What number is it which ends in the figure "2," which, when the "2" is transposed from the rear to the front—or from the right end to the left end—is now twice as great as the original number.

These have been elaborated by Mr. Mitchell Selligman, an architect of Pine Bluff, Ark., whose office adjoins that of the city engineer, Mr. Elson Hale, also a *Brainteaser* fan, as follows:

(a). What number is it, that if its last digit is removed, tripled and transposed to the front of the original number, is then five times as great as the original number?

(b). What number is it, that if its last digit is removed, quadrupled and transposed to the front of the original number, is then seven times as great as the original number?

(c). And here's an easy one. A number ends in "4." Transpose the "4" to the front, and the result is a number 4 times the original number. What is the number?

The *Brainteaser* editor will return shortly and we will then publish the solutions of the August Brainstorms.

W. A. H.

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A. PRESCOTT FOLWELL, *Editor* **W. A. HARDENBERGH,** *Asso. Editor*

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 64 — *September, 1933* — No. 9

Getting Competent Contractors for Your Job

By E. Bender

DURING the last few years, especially, competent and reliable contractors have been confronted with an unusual and trying situation. When bidding on projects, they have been forced to compete with many types of contractors. Some of these are bidding on work foreign to their usual line; some are making their debut; some are willing to take a gamblers' chance; and some are going in on a shoestring, with nothing to lose.

Before You Sign the Dotted Line

Every city, town, private corporation, or individual desiring to have work done on a competitive basis has that right; but there are no substitutes for good workmanship and legitimate business methods. Executives who are intrusted with the responsibility of awarding contracts may be compelled to award all contracts to the lowest bidder regardless of his experience or integrity as long as he supplies the requirements of proven responsibility, which too often means only the "Bond." But the bond is not all that should be required to consider the contractor responsible, competent, and reliable. His financial standing, his experience, his organization, and the successful completion of similar projects have an important bearing in qualifying him as a responsible bidder for the work to be performed.

When a contract has been awarded and unsatisfactory work performed, it is too late to reflect on what might have been done to avert the mistake. A step in the right direction before bids are accepted will avoid such difficulties. The executive's ability, and his freedom to judge a competent contractor, should be exercised to the utmost prior to awarding a contract and not after he has demonstrated a default. The client, public or private, must not lose sight of the fact that if his projects do not receive first class workmanship, materials, and equipment, as called for, he may be compelled to make further expenditures shortly after completion of the job.

Specifications Should Be Clear

Mistakes occur in a contractor's estimate when plans and specifications are vague and inconsistent and therefore difficult to interpret, that is from the standpoint of figuring on the items which have been intended but were not clearly set forth. The conscientious contractor being careful of his reputation will endeavor to have such discrepancies settled before bidding if time permits. It may be that the opportunist contractor using his own discretion in such instances will not estimate in accordance with the intended meaning, consequently after the work has been started disputes arise, delays occur, and in all probability unsatisfactory workmanship is the result. Again the contractor who calls attention to discrepancies or omissions that are likely to be misconstrued or omitted by the inexperienced contractors may find he is handicapped because he has estimated on the correct meaning or intent of the specifications.

Courtesy Harnischfeger Corporation

Financing the Work Before Bids Are Made Public

Advertising for bids when financing of a project has not been completed often becomes a hardship to contractors and a possible loss to the client. The practice of trying to dispose of bonds after bid prices have been made public may be wise to discourage. When financial negotiations are not satisfactorily completed in due course of time after bids are made public, new lettings result. At the subsequent letting with the plans and specifications remaining unchanged, any contender may assume that the low bid price at the first letting will in all probability be the maximum or high bid at the second letting. Therefore, contenders know a figure established by the previous low bidder and in order to have any chance for the work they must reduce their original price below that figure or otherwise refrain from bidding at the next letting. The competent contractor who bids under these circumstances must sacrifice his profit if all terms in the contract remain as before. The incompetent contractor not realizing the importance of abiding by the plans and specifications may shop around for lower prices regardless of the quality and unless the plans and specifications are exceptionally rigid and precise he may be successful, at least, as far as he is concerned.

Ability of Contractors to Execute the Work

In preparing plans for various projects, mechanical equipment plays an important part, and therefore, must be incorporated to show its purpose and relative importance to the adjoining apparatus for proper clearances and for practical methods of erection and operation. In many cases the engineer desires equipment of a certain manufacture or equal and accordingly bases his plans and specifications in line with those of the manufacturer he men-

tions. When prints of certain equipment are supplied to the engineer they are, as a rule, tentative. The authentic or certified prints are furnished to the purchaser of the equipment. However, it is best for a contractor to obtain certified prints of all important parts, and also the engineer's approval.

In this connection there is often a certain amount of engineering necessary to lay out the equipment after obtaining these prints. The contractor who maintains an engineering staff and organization for this type of service is of great assistance to the client, engineer and other contractors connected with the work. If a contractor does not render this service it must revert to the consulting engineer or his staff in the field if good workmanship and complete satisfaction are desired. If a contractor does not possess the ability to plan his work along these lines he not only delays his own but the work of other contractors.

In work involving a number of projects one of the requisites for obtaining plans and specifications has been the use of a questionnaire in which the applicant is required to give satisfactory data on the following:

A.—Financial statement.

B.—Equipment available.

C.—Names of members of his organization he proposes to use in execution of the work.

D.—List of like projects executed.

This tends to limit contractors competing to those qualified to do the work satisfactorily; gives the engineer and client a better opportunity to obtain information about the bidders; and insures sincere and honest competition, and consequently higher type bidders.

Non-Odorous, Non-Bacterial Sewage Treatment

A PROCESS of treating sewage has been developed by A. R. Putnam, sanitary engineer, of Valparaiso, Ind., during the past four and a half years, the purpose of which is to obtain, by non-bacterial treatment, any desired degree of purification by means of a plant occupying a small area and non-odorous so that it can be placed any where in a city without being a nuisance. Mr. Putnam also believes that it "will produce its own revenue without resorting to taxes or sewage rental assessments."

The sewage first receives activated carbon, which removes the methane, ammonia, hydrogen sulphide or other gases present. Three grains per gallon is effective for fresh domestic sewage; 5 or 6 may be desirable for stale or septic sewage.

It then enters a receiving well, where about 5% of the sludge previously removed is returned to the sewage. Milk of lime is then introduced, the rate depending on the pH of the sewage. Three grains per gallon is used for Valparaiso sewage.

Ferric chloride is then added as a coagulate (1.5 grains per gallon is used in Valparaiso), and the sewage is pumped (if pumping is necessary) into a mixing trough and passes into vertical flow sedimentation tanks. The weight of the carbon aids in precipitating the suspended matter.

The effluent is aerated, treated with a sterilizing agent and passes to a sterilizing tank, the bottom of which contains a half-inch of carbon supported by a 16-inch layer of sand if filtering is thought necessary. This completes the treatment of the liquid.

The solids settling in the sedimentation tank (which is cylindrical and contains a sludge scraper which makes one revolution per hour) are drawn off by either gravity or pump to a sludge tank, the supernatant from which, and part of the sludge, are returned to the receiving well.

The sludge from this tank is dewatered by a vacuum filter (or otherwise) and passed to a retort with three heating compartments, one above the other. Entering the top compartment, the sludge is raised to 70° C. and most of the moisture driven off; then it is dropped to the middle compartment and the temperature raised to 100° and practically all the remaining moisture driven off; then it is dropped to the lowest compartment and raised to 400° and all remaining moisture and gases driven off and the ferric hydroxide (derived from the ferric chloride) converted into ferric oxide which, combined with the carbon resulting from the charred sludge, gives this weight which adds to its efficacy in settling the coagulated solids in the sedimentation tank.

The charred sludge is then reduced to at least 200 fineness by use of a small hammer mill, screened, and the necessary amount applied to the raw sewage as previously described. After passing through the treatment several times the carbon will accumulate an undesirable amount of mineral matter and should be discarded and a fresh start made.

The vapor driven off by the retort is very complex in composition. It is carried to a holding tank, where it is condensed and the ammonia and other gases are absorbed by the water, those not absorbed being carried to the furnace of the retort and burned as auxiliary fuel.

The charred sludge not used in the process can be used commercially.

The condensed vapor has been found to contain ammonia, alcohol, urea, phosphoric acid, skatol, potassium, calcium, chlorine. It does not putrefy during 8 months' storage. Mr. Putnam has found it to be an excellent fertilizer and also an exterminator of bugs, worms, scale, etc., on vegetation but harmless to animals.

The complete plant includes a screen and rotary sizer that will cut the screenings to ⅛ inch size, when they will be added to the sludge. In addition there are: a receiving well; mechanical feed for carbon and lime; pumps and motors; mixing trough; ferric chloride feed, with control; return sludge line to receiving well; coagulating tanks to provide a flowing-through period of one hour; sterilizing tank; sludge draw-off line and pump; two sludge tanks; sludge dewaterer; retort and condenser; pulverizer, with screens, blower and sacker.

The experimental plant treating the sewage from more than 700 people occupies a space 14 by 16 ft., in a thickly populated part of the city, and the nearest residents did not suspect its purpose during two years of actual operation.

Including a building of pressed brick, the cost of such a plant Mr. Putnam estimates at $42,000 for 50,000 g.p.d. to $204,000 for 900,000 g.p.d., based on 1932 prices. The cost of operating a 3 m.g.d. plant he estimates to be $22.60 per million gallons, not including interest or depreciation on the investment.

Water Works Reconstruction Financed from Earnings

Mechanical Mixers at Macon, Ga., Water Works

By H. F. Wiedeman
Of Wiedeman and Singleton

TOP: *View from sedimentation basin. New construction in foreground. Left background, old pumping station.*

LEFT: *Laboratory.*

RIGHT: *Mixing basins in right foreground. Laboratory and chemical house in background. Outlet flume in middle foreground. Stilling wall and sedimentation in left foreground.*

THE complete reconstruction of the Macon, Georgia, water purification plant, in accordance with a planned program which will require several years and which will be financed from earnings, was started about six months ago, when the first unit in the program was placed under construction. This unit has been completed and is now in operation.

The program was arranged for construction in such a way that there would be as little interference as possible with routine operation and in the order in which maximum operating benefits would be derived from the completed construction.

In practically all plants constructed at the time of this plant, the processes preliminary to filtration received little thought from the designers. Emphasis was always placed on the filter design. Most water purification engineers in recent years, however, have come to realize that 95 per cent, or more, of the work is performed in coagulation and sedimentation, and if proper equipment and structures are provided, a better product for this portion of the process may be produced at lower cost and many filter operating difficulties may be eliminated.

The raw water supply for the Macon plant is obtained from the Ocmulgee river. This stream is always turbid, frequently reaching 2000 to 3000 parts per million turbidity. The bacterial load, however, is light. It may be treated without any great difficulty to produce a clear effluent, and its mineral content is very low, thus affording an excellent water for domestic and industrial use.

This plant was originally privately owned and was one of the first rapid sand filtration plants built in the South.

There are two double banks of filters, having a normal rating of 14.5 million gallons daily. The design, however, does not permit adequate washing, with the result that the sand beds cannot be kept in good condition, although the amount of filter wash water is excessive.

The maximum rate of filtration during the summer months is approximately 8,000,000 gallons daily. There are two sedimentation basins, having a combined capacity of 5,000,000 gallons, which, if proper reaction and coagulation facilities were provided, would be more than is necessary to provide a properly conditioned water for filters operating at a 15,000,000 gallon rate. These facilities were lacking, however, and water was often applied to the filters with turbidities of 100 to 150 parts per million, resulting in a filtered water of 5 to 10 parts per million or more.

It was evident that the funds available could be most profitably employed by increasing the efficiency of the primary process and the first part of the construction program, consisting of Mixing Basins, Chemical House and Laboratory, and alterations in the Sedimentation Basins, was authorized for construction.

The mixing basins consist of two 30′ x 30′ concrete tanks, 12 feet deep, constructed within one of the sedimentation basins, which are trapezoidal in shape. The mixer paddles consist of steel plates swung from a horizontal arm attached to a vertical shaft. Direct current

is generated at the plant for the operation of the raw water pump and other general purposes, and is used for driving the mixer mechanism. The paddles are driven through a reduction gear by a spur gear and pinion. At normal operating speed about 1½ horsepower is required for the operation of each mechanism. The paddles operate at ½ to 1½ r.p.m., which produces a paddle velocity at the end of the paddle arm of 0.77 to 2.35 feet per second.

The mixers may be operated either separately, in series or in parallel. A short period of rather violent pre-mixing is provided by over and under baffles, to mix the chemicals thoroughly with the water, in order to avoid unequal chemical distribution which so often takes place when the flow is divided between two or more mixing tanks.

The water enters the mixing tanks at the bottom, at one side, and in the direction of rotation of the paddles, and flows out through a circular steel launder in the center at the top to a distributing flume which feeds both sedimentation basins. Launder and distributing flume are designed with ample capacity to minimize disturbance as much as possible. The distributing flumes discharge behind a perforated stilling wall and the settled water is taken off back of a weir wall.

Hydrated lime is added to the clear-water well but is first passed through a settling cone to remove grit and other inert matter which formerly settled in the clear-water well.

A marked reduction in the amount of alum used has taken place since this equipment was placed in operation, reaction and coagulation are more easily obtained, and the settled water turbidities never exceed 25 parts per million, irrespective of the raw water turbidities. The filter loading has been reduced, thus producing a better filter effluent and decreasing the wash water.

A venturi meter register measuring the raw water is placed in the laboratory and beside it is placed a push button switch which operates the rheostat on the raw water pump at the river, about 2,000 feet from the laboratory. This enables the operator to increase or decrease the raw water flow and to know accurately at all times the amount of water he must treat, without leaving his laboratory.

The Macon water works is operated under the direction of a Board of Water Commissioners, consisting of Cliff Williamson, chairman, C. H. Hunnicutt, vice-chairman, Jesse Mitchell, and R. E. Findlay, secretary-treasurer.

R. A. Bowen, of Macon, was general contractor and Taylor Iron Works, of Macon, and Burford, Hall and Smith, of Atlanta, furnished and installed the equipment. T. E. P. Woodward was field engineer in charge of construction.

Painting Standpipes and Elevated Tanks

By H. E. Newell

Superintendent Water Plant, Webb City, Missouri

To preserve the life of standpipes and elevated tanks, the paint should be inspected on the inside and outside at least once every two years and should never go over three years. I find the inside of tanks require more attention than the outside. The mistake is often made of neglecting the paint on the inside of standpipes and elevated tanks.

In order to make the paint adhere to the tank it is very important to remove all the old paint and scales. We experimented on cleaning and scaling the inside of tanks. First we tried the painters on a set of rope falls swinging from the top, but found this was not satisfactory. After the painter was down about 50 feet from the top, when using the brushes and scalers he pushed himself away from the tank and could not apply the necessary pressure to his tools to remove the scales and old deteriorated paint. We then built a platform on the inside of the tank and swung this platform on four sets of rope falls. This enabled the painters to get all around the tank at one setting and give the tank the thorough cleaning which is necessary before the paint is applied.

Summer weather is the best time to paint tanks, as the paint flows more evenly and penetrates the pitted places. Each coat of paint should be thoroughly dry before the next coat is put on. After the last coat of paint has been applied to the tank it should be allowed to dry from 60 to 72 hours before it is filled with water.

I would not care to recommend any one paint as there are so many paints on the market, but would advise a paint especially prepared for water tanks.

The above is a brief paper before the eighth annual Missouri Water and Sewerage Conference.

Activated Carbon and Ammonia-Chlorine in Water Purification

Information has been obtained from a number of water works superintendents regarding the use of activated carbon and ammonia-chlorine. Replies from 517 cities have been tabulated. (Additional replies since received have not been included.) Of these cities, about one-third have treatment plants, about one-third do not have treatment plants, and the remaining one-third did not state, and time has not been taken to check up on records of these in this office, since it is not a factor of importance.

The use of activated carbon was reported by 81 cities, and of ammonia chlorine by 76 cities. In many ways, the statements regarding these tallied closely. In response to the question: *What results have you obtained from the use of this material?* the replies were: Activated carbon, *Excellent*, 19; *satisfactory* or *good*, 56; *unsatisfactory*, or *poor*, 4. Ammonia-chlorine, *Excellent*, 13; *Satisfactory* or *good*, 55; *unsatisfactory* or *poor*, 5.

Activated Carbon.—There are four principal methods, or combination of them, which are used for applying activated carbon. These are, a, on the filter, reported by 8; b, in the settling basin, reported by 11; c, during the coagulation process, reported by 8; and d, direct with the coagulant, reported by 30. Combinations of the methods were reported as follows: a and b, 2; c and d, 5; b, c and d, 4; a, b, c, and d, 2; b and d, 2; b and c, 1; and a and d, 3.

Ammonia-Chlorine.—Some of the comments regarding the use of ammonia-chlorine are of interest. One superintendent stated it was "excellent for phenolic tastes; results justify its continued use." Another said it "raised the chlorine residual 0.3 ppm.

Ferric Chloride.—Two cities reported using ferric chloride for coagulation.

The illustration at the right shows the broom drag, an important piece of equipment for spreading smoothly and evenly the aggregate for the seal coat. Below is shown the heavy drag, valuable in getting thorough mixing and almost an essential in mix-in-place work.

Cut-Back Asphalt Used in Mixed-in-Place

MIXED-IN-PLACE construction is being used for surfacing 5¼ miles of Route 52, New York State, between Youngsville and Jeffersonville, in Sullivan County. This is a portion of a heavily traveled secondary route serving a resort section. A connecting strip, Liberty to Youngsville, 6¼ miles, was surfaced last year using Tarvia. Socony cut-back asphalt is being used on this job.

The road being surfaced was constructed in 1909 as waterbound macadam; since then it has received occasional reconstructions and mat treatments, and in general has given excellent service.

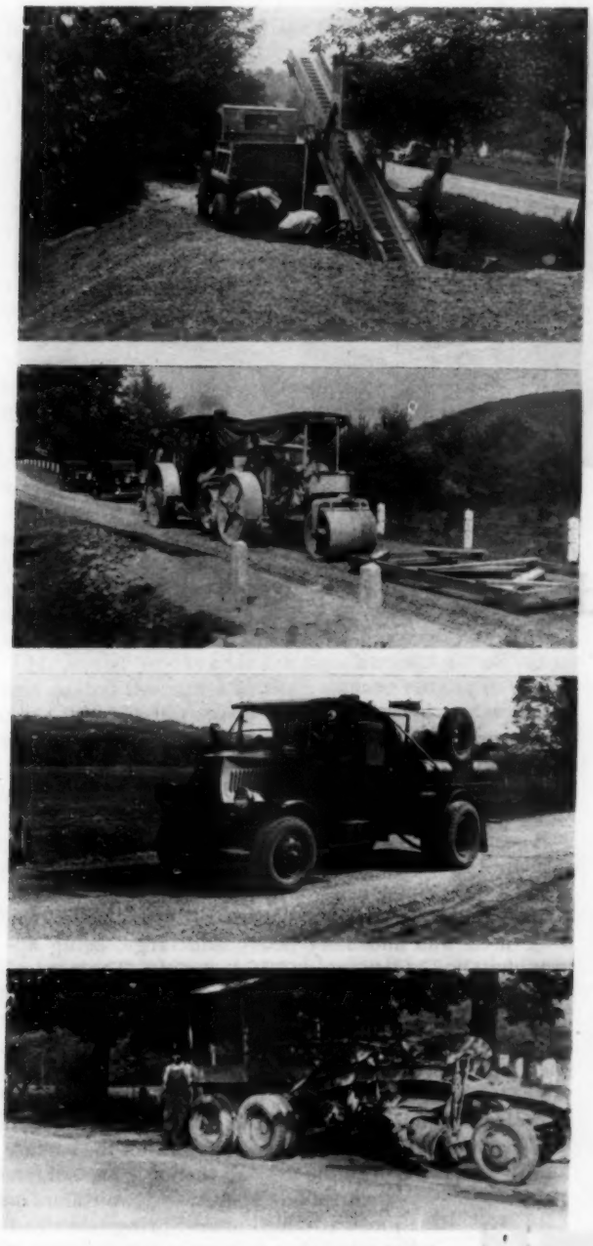
The construction procedure followed in resurfacing is essentially that of the macadam aggregate, mixed-in-place, as outlined previously in these pages. The road was not scarified, and because of its uniformly good surface conditions no preliminary patching or other preparation was found to be necessary. Stone was hauled from the quarry near Kenoza Lake, roughly 4 to 8 miles distant, and spread on the old surface to a depth of 3½ to 4 inches. Practically all of this was spread by dumping into a Galion spreader from a truck.

After preliminary leveling to insure a fairly even spread, 1¼ gallons of asphalt per square yard was applied. The stone then was dragged to insure thorough mixing and to provide a smooth riding surface. The drag used was unusually heavy and large, being approximately 22 feet long and 10 feet wide. The general construction is shown in the accompanying illustration. This was hauled over the road an average of three trips, using, for part of the time, two FWD trucks, and later one Linn tractor, which proved very efficient in pulling the heavy drag through four inches of loose stone.

Following the dragging and mixing, an Austin dual-drive motor grader was used to smooth the surface finally and bring it to the desired section. The surface was then rolled. There were two rollers on the job, a 10-ton Buffalo-Springfield steam roller which has seen some twenty years of road-building service, and an Acme 7-ton gasoline driven roller, which was used for rolling both the base course and the later seal coat.

The drag used in mixing aggregate.

The seal or cover coat consisted of ¼ gallon per square yard of cut-back asphalt, covered with 20 pounds per square yard of stone chips. These were spread with a Hvass rotary spreader, with the truck dumping directly into the hopper of the spreader. Since this hopper was shorter than the width of the truck bodies, an ingenious device consisting of two right-angled triangles, constructed of 2 x 12 plank (or 3 x 12) was placed in each of the rear corners of the truck bodies. These had a base of 2 feet, and a hypothenuse of 4 feet, two of them thus constricting the



On the job: Top, a portable elevating loader; next, two rollers follow the broom drag; next, the distributor starts back 10 miles for another load; bottom, the grader ready to work.

dumping width of the truck body by 4 feet, and allowing discharge into the spreader hopper with a minimum of spilling.

The seal coat procedure thus was the application of asphalt, the spreading of chips from the rear of trucks which backed down the highway, and the brooming in of these chips by means of a broom drag, shown herewith. This broom drag was attached to a light truck, and hauled slowly over the lightly spread cover stone. The rollers followed closely after the broom, giving the finishing touch to the surface.

The cover stone had been stored in stock piles along the road side. This was loaded into the trucks by means of portable elevating loaders. The one shown loading the truck in the illustration was manufactured by the Portable Machinery Co., Clifton, N. J., while the one in the background (barely seen over the top of the truck) was furnished by the Supertrough Co. of Passaic. These loaded the trucks quite rapidly and allowed four trucks to handle enough cover material with a haul of about four miles, thus reducing the number of trucks required if loading had been done by hand. On this work, there were a Mack 3-ton, an FWD 4-ton, and two Brockway 3-ton units.

The work was done under the general direction of the Binghamton District office of the New York State Highway Department, with Thomas C. Rogers as county engineer in charge. William H. Norton was the operator of the Austin grader.

Weeds Kept Mowed for Safety and Beautification

Safety as well as beautification is the object of the state highway department in keeping tall weeds mowed down along the rights-of-way of all state roads throughout the 12 highway divisions in Ohio.

Reports received by Highway Director O. W. Merrell from the division engineers show that the mowing work is going forward uniformly over the entire state in a satisfying manner. Specifically, Ivan R. Ault, engineer in charge of Division No. 3, reports that approximately 1,110 miles of state-maintained roads in the eight counties of the division have been completely mowed during the past several weeks. Weeds are mowed on berms betwen the pavement and ditch, to the fence lines, around all guard rails, bridge headers, warning signs and reflectors, and also at all road intersections to maintain unobstructed sight views and thus greatly increasing the safety of driving.

In many instances the weeds are burned in order to destroy the seeds and the possibility of destructive fires occurring from matches or cigarets thrown from passing machines on to the dry weeds and grass strewn along the road-bed following the mowing.

The mowing operations are intermittently repeated so as to remove vegetation and growth springing up since the previous mowing.

Road Contractor Gets Repair Part in Record Time

A contractor on road work near Framingham, Mass., recently had the misfortune to break an important part of a vital piece of equipment manufactured at Racine, Wis. Until this could be repaired, his crew must remain idle. It was afternoon when he telegraphed the manufacturer to hurry the needed part with all possible speed, and by noon the next day it was delivered to him. The manufacturer put the matter up to the Railway Express Agency in Racine, at 5:30 p. m., got the part on a train for Chicago, which it reached at 7:05, and by 8 it was being speeded by air express to the Newark, N. J., airport. Reaching here at 6:43 the next morning, it was forwarded by fast motor truck and express train and was on the job before noon.

The same agency sent repair parts for a Beloit manufacturer to a contractor at Hermosa, Wyo., by rail to Chicago and by air service to Cheyenne, Wyo., in ten hours, and by express from here to Hermosa.

The Digestion Tank

A Digest of the Sewerage Literature of the Month

For more than two years we have published each month, as a special feature, a digest of the water works literature of the previous month. This has been so highly appreciated by water works men that we have decided to give a similar service in the field of sewerage and sewage treatment. The Digestion Tank *goes into service this month, seeded with the ripened results of two years' operation of the "Water Wheel." We hope that each monthly drawing of sludge will be found by sewerage designers and operators to be well digested and a good fertilizer of ideas.*

TRICKLING filter practice as set forth in 467 articles, pamphlets and books between 1868 and 1932 was studied by I. O. Lacy[21] and showed a wide diversity of common practice in size and material of filtering media, laterals, distributors, depth, loadings and ventilation, and in trouble from and method of curing pooling, filter flies and odors. However, he found general agreement on the following: "That in a well-working filter, vitrification does take place; that the demand for oxygen is reduced; that some solids are retained; that better results are found where a film is on the stone; that there is some clarification between the liquid applied and that of the effluent. As to an explanation of the phenomenon mentioned, we find it impossible to give a definite one. There are too many conflicting theories that must needs be considered.

"That at seasonal periods, or continuously, the filter bed proceeds to free itself of the black solid content" although "we are not sure of the mechanics involved in this sloughing or sluffing. Physical, chemical or biological reasons may be given, and all with some data to prove the point that this unloading is due to any of the three causes mentioned or any combination of the three.

"The time interval between dosing and resting is not definitely fixed. The operator may learn by experiment that shorter periods of sprays applied more frequently increase the efficiency of the bed."

At Plainfield,[23] if the sprinkling filter effluent is dosed with 132 lbs. per m.g. of anhydrous ferric sulphate (or a corresponding dose of ferric chloride) it always precipitates fully, and the precipitated sludge is an effective clarifer of the raw sewage and may be substituted for 132 lbs. of iron salt in any required treatment of the raw, and also has a marked odor-absorbing effect.

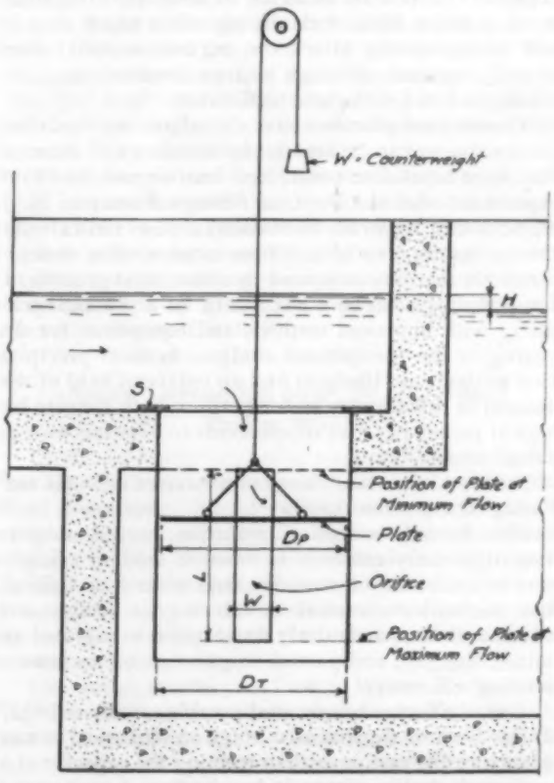
At Princeton[28] the dosing tank is cleaned three times a month, accumulating from one to two inches of grease on the side walls during that time. A part of the final sprinkling filter effluent is run into a small aquarium, where fish and other aquatic life flourish.

At Freehold,[29] grease caused a deposit of a yellowish slimy substance on the bed, which was removed quickly by increasing chlorine dosage in dosing chamber to 10 p.p.m.

Prechlorination of sewage does not affect digestion. Said Dr. Rudolfs:[26] "The organisms in the raw sewage play a very small part in the digestion process. It is the organisms developed in the digestion tank that do the work, and consequently killing off a portion of the organisms in the raw sewage is not going to materially affect the function of digestion. It is another thing if you use chlorine directly to the digestion tank, where you kill off all or a portion of the organisms." No matter how much chlorine you apply in prechlorination, "apparently, if you have enough ripe sludge present in the digestion tank there is no harm done."

It is the opinion of J. Russell Riker[28] that "It is important to keep the prechlorination as low as possible for I believe it interfered with the sprinkling filter during January." With a dose of 2 p.p.m. effective chlorine applied to the final effluent "we obtain a residual in the final effluent of at least 0.1 p.p.m., after from one to two hours' contact with the chlorine in the final settling tank."

Digestion tank decanted liquor furnishes a problem at practically all sludge digestion plants. At Prince-



From "Water Works & Sewerage," August

Constant-head variable-orifice flow meter.

ton.[28] with a flow of 1¼ m.g.d. it averages about 5,000 g.p.d. and is very offensive, being highly charged with hydrogen sulphide. It is discharged slowly into the raw sewage, with "no ill effects in the primary settling tank, but we can not let it come in contact with the open air or the obnoxious gases will escape. We have tried running it to the sludge drying beds but do not recommend this procedure. The sludge bed effluent is discharged into the final settling tank, after first being chlorinated." The final settling tank sludge "in my opinon should be discharged directly into the digestion tank" rather than into the primary settling tank.

Chemical treatment of sewage may be either for precipitation or for conditioning.[23] In the former case there are complicated reactions in which the metallic part of the precipitating salt units with the O H radical of water to form the hydroxide of the metal, while the acid radical unites with the calcium of the sewage; and theoretically distinct changes in pH are required before precipitation can be completed. In applying diminutive doses of iron salts for removing the organic load of sewage, they appear to be absorbed by the organic matter in suspension, as in the art of dyeing and mordanting. In the former case the amount of sludge is greatly increased; in the latter, the weight so added to the organic matter causes it to settle rapidly without forming voluminous floc, and "it is possible to secure a 50% reduction of organic load with less than 50% increase in sludge volume. Such results have been attained locally with a dose of 400 pounds of Calcoag (75% ferric sulphate) per million gallons of sewage." . . . Raw sewage varies widely from hour to hour as to the amount of iron salt required for precipitation. This range may be said to be from 300 to 1050 lbs. per m.g. of anhydrous ferric sulphate. . . . As little as 50 lbs. of anhydrous ferric salt per m.g. has a distinct clarifying effect which may be said to specifically attack the organic material when properly applied, although no true chemical precipitation is produced with these small doses."

"Commercial processes have already shown that effective treatment can be secured by less doses of chemical than were heretofore considered feasible and the recent experiment station (Dept. of Sewage Research, N. J. Agricultural Experiment Station) studies indicate that similar results may be had from much smaller doses of chemicals than are now used in commercial practice. If these findings can be made use of on a practical scale along with improved methods and equipment for disposing of the precipitated sludge, chemical precipitation methods are likely to find an enlarged field of usefulness in this country in competition with simpler biological processes or as supplements to existing biological processes."[31]

The most important chemical treatment methods are[24] liming of digestion chamber for pH adjustment; chlorination for odor control, disinfection, partial stabilization of primary effluents, increase of settling efficiency due to inhibition of septicity, and control of bulking; the mechanical-chemical dewatering of sludge over vacuum filters, particularly its adaption to digested and mixed sludges; and partial coagulation for increase of settling efficiency.

Use of chlorine has secured notable results in 1932.[25] It has been of distinct advantage in biological sewage plants, in one case more than trebling the capacity of an activated sludge plant; it has become a necessity in many of the chemical precipitation plants using iron; has been used economically to produce ferric chloride by passing it through scrap iron, and has been used to form cupric chloride; has been used to control odors without satisfying the chlorine demand; has been found to combine with much of the dissolved putrescible matter, permanently stabilizing it; in combination with lime has been found to reduce algae growth in the receiving waters. "By far the most important developments have been: (a) The increasing use of chlorine to prevent septization of sewage; . . . (b) The use of chlorine to reduce oxygen requirements of sewage effluents and improve stream conditions. (c) The increasing use of chlorine in the form of ferric chloride."

Operating a mechanical aeration plant at Collingswood, N. J.,[27] cost about $40 a million gallons in 1932, or $50.57 if we include $3.60 for maintenance of grounds and about $7 for pumping. The cost of chlorine was $2.06; materials and supplies, $2.18; operators' wages, $21.91; repairs to machinery and tools, $1.59; light and power, $19.08; insurance, $0.68. About 50% of the suspended matter is retained in primary settling tanks; the sewage then is aerated with Link Belt mechanical aerators having a flowing-through period of 6 hours and a cross-tank velocity of 2½ ft. per sec.

Because the present flow is less than that designed for, the long detention in the two primary settling tanks resulted in a removal of more than 75% of the suspended matter, and one tank was cut out of service, halving the detention period and reducing the removal to the desired 50%.

Return sludge is added to the aerating tanks 15 ft. from the influent ends. The amount returned depends on the amount settling out in a 1,000 cc glass in one hour, tests of this being made every 2 hours. Twenty per cent gives the best operating conditions, and the amount returned is increased or decreased to maintain this. Sludge not returned to the aerating tanks is returned to the primary settling tanks. At first it was run directly to the sludge digestion tanks, but the water content was too great for satisfactory settling. The overflow from the digestion tanks is passed again through the entire plant.

The digested sludge dries in two weeks and is odorless and black. The air-dried sludge is run through a shredder and sold for $2.50 for 1½ cu. yd. Not being dry enough to pulverize, it forms a leathery fibre which is found to be excellent for lawn dressing and garden mulch.

Rug mill waste practically rendered inoperative the sewage treatment plant of Freehold, N. J.[29] This waste, constituting 30% of the total sewage, consisted of two thirds spent dye water and one third wash water with a chlorine content of 15 to 20 p.p.m. and was discharged into the sewer at steaming temperature, so that the raw sewage entered the settling tank 5° to 10° higher in temperature than that in the tank, and flowed through the tank in a thin stratum in approximately 40 minutes, with only 20% to 30% reduction in suspended matter. Therefore the industrial waste is now pretreated at the mill and flowed onto an old broad irrigation area.

Sewer rentals as a means of financing sewerage construction and maintenance are collected by 35 New Jersey municipalities.[20] The rates vary from a minimum of $2 to a maximum of $15. In most cases they are based on fixture charges, water meter flows, or set rates for

(Continued on page 34)

THE EDITOR'S PAGE

Finances of Cities

There has been much shaking of heads and muttering into whiskers concerning the sad financial plight of our cities. There have been doleful murmurings regarding past capital expenditures for highways, water works, sewers, sewage treatment plants, and refuse disposal installations, with consequent heavy taxes carrying the poor taxpayer down into a financial morass.

Newspapers have given a good deal of publicity to the few cities that are in trouble, but in almost every case such trouble has been due to political misgovernment, rather than to expenditures of the type mentioned above. Even when highways, sewers and water plants have been involved in excessive expenditures, it has been graft and politics of the worst type, rather than honest construction of needed services that is the cause.

It is true that many millions of taxes are in arrears. Faced with a reduced income, many cities have reduced their expenditures. But consider the other side of the picture for a moment. This tax arrearage is the best secured of any debt in the world, coming before first mortgages or anything else. It carries a rate of interest about double what the city can borrow money for. It will all be paid ultimately. Then the city treasury will be in better shape than it ever has been.

Few cities have ever done too much honest development of water or sewers or waste disposal, or laid too many honest miles of streets. They have never oversupplied themselves with equipment because the terms of sale were foolishly easy—as many contractors did. The equipment they have on hand now is wearing out; it has not been replaced as replacements were needed. Streets are wearing out and new ones are needed; increasing population demands improvements in water supply; health protection demands more sewage treatment and refuse disposal installations.

We believe that within two years, city finances will be in better shape than they have ever been—except in cities where political mismanagement rules—and that within that time there will be more activity in the municipal and public works field than there has ever been. The retarded developments of the past three years will have to be made up, and the sooner this is done the less the cost and the loss from insufficiency.

"Earnings" of Water Works Plants

In this and other issues of PUBLIC WORKS, stress has been laid on "earnings" of water plants. The overtime use of this word is not the result of a limited vocabulary on the part of the editor, but of a distinct purpose to emphasize the fact that properly operated water works systems can be and usually are self-supporting, or even profitable.

Due credit must be given to the energy and technical ability of the water works superintendents for their part in this accomplishment, and we congratulate them in this regard. There are few if any other benefits that the citizen, as either householder or taxpayer, can obtain for so little expenditure of money. The benefits he receives in comfort and in fire and health protection are of inestimable value.

Yet there are still thousands of communities without an adequate supply of pure water. We shall spare no effort to acquaint these with the many advantages of such a supply.

Civil Service Positions for Engineers

For the first time in many moons—to be exact, for the first time since August, 1931, if our research and our memory are correct—we carry a notice, on page 49, of an examination by the U. S. Civil Service Commission for engineers of all grades, assistant, associate, engineer and senior engineer, and in nearly all branches. It will be a non-assembled examination, the competitors being rated on education and experience. Applications must be in the hands of the commission by Sept. 28. Necessary blanks can, we believe, be obtained from the principal post-offices.

We hope this means there will be openings for a considerable number of engineers and that they will be taken on at the earliest possible moment. Salaries quoted in the notice are not unreasonable, considering the very inadequate pay many state, county and city engineers are now receiving, even allowing for the 15% reduction now in force.

Solving the Relief Problem

In an early issue of PUBLIC WORKS will appear an account of the methods by which the city of Port Jervis, N. Y., population 10,000, with 30% of them on the relief rolls, solved the problem of unemployment relief through worthwhile public works construction. The fact that 600 heads of families needed help is no reflection on that community, since this was due to local circumstances of a rather unusual nature.

The coming winter will present similar, though probably less serious conditions, in many other municipalities. If the responsible heads of those municipalities wish to know more about the able and courageous work at Port Jervis, pending the appearance of this article, they can do so by getting in touch with the Mayor of that city, Wendell E. Phillips.

Speed Demanded on P. W. A.-Aided Public Works

Cities and states can, under a ruling made on September 5th, obtain allotments from the Federal public works fund (of which $1,300,000,000 was still available on that date) only on condition that "not later than thirty days after such allocaton the financial and engineering features of said project be worked out and a final contract satisfactory to the administrator of public works be executed, failing which the tentative allocation shall be without effect.

For several months past PUBLIC WORKS has been urging cities and states to have plans ready for immediate use. The wisdom of this is now apparent. Those who must now speed up their planning should make special effort to avoid mistakes and unwise planning so likely to result from haste.

Iron Removal Plant Paid for From Earnings

By E. Roy Wells
Wells Engineering Company, Geneva, Illinois

Geneva water works pumping station

FOR more than thirty years Geneva, Illinois (population 5,000), obtained its water from two deep wells, pumping by air lift into a surface reservoir and then into the distribution system. The growth of the city during the past few years demanded additional water supply and the council authorized the construction of a new deep well. Since this growth had been primarily to the north and west, and the feeder mains were inadequate in this section, it was decided to locate the well in the northwest corner of the city, in a Class A residential section. A contract for the construction of the well was awarded to W. H. Cater Company of Chicago, Illinois.

The new well, known as the Logan Avenue Well or Well No. 3, consists of 65 feet of 20-inch O.D. wrought iron casting ⅜ inch thick extending through the unconsolidated formation and seated in the top of the Niagaran formation, and continuing with an open bore hole 19 inches in diameter through the St. Peter sands to a depth of 977 feet. The static water level in the well was 48 feet 9 inches.

Pumping Equipment

A Byron Jackson 15-stage turbine pump with Kingsbury thrust bearings was installed by the well contractor. The outside diameter of the pump bowl is 13⅛ inches. The impellers are bronze, and the runner shaft stainless steel. A brass cornucopia strainer is fitted on the suction end of the 20-foot standard tail pipe. The pump bowls are suspended from the pump head by 302′ 10″ of discharge column and shafting. This column consists of 8-inch standard pipe with 2½-inch extra heavy inner column or oil tube and with 1 11/16 inch turned and ground stainless steel shaft. The shafting is supported by bearings spaced 6 feet apart. The column sections are made up in lengths of 12 feet each, except the short lengths at the top.

The pump bowls are of the pressure relieved type, with drainport at the top bearing for the purpose of relieving the shaft tubing from pressure due to water forced from the top stage of the bowls through the top bearing into the shaft tubing. This permits the feeding of oil by gravity from the surface by the use of an automatic lubricator electrically controlled that starts and stops with the motor.

Oil Lubrication Reduced

During the acceptance tests, the water was pumped through a fire hydrant near the site of the well and was wasted upon vacant property. Examination of the pools of discharged water showed a substance floating on top that had the appearance of oil. At this time Geneva and the surrounding territory was at the height of a purported oil boom. Oil was reported to have been discovered just west of the city and a rig was drilling for oil three-quarters of a mile from the Logan Avenue well.

The engineers skimmed samples of the substance from the surface of the pools on to filter paper and sent the samples to the Armour Institute of Technology for analysis. The Institute's report stated: "The samples taken on filter paper are oil and have most of the characteristics of a good grade of lubricating oil." A sample of the lubricating oil used in the pump was then forwarded for inspection and the Institute reported the oils to be identical.

The contractor then reduced the oil delivered to the pump to six drops per minute. The substance floating on the surface of the pools cleared after some continuous pumping. Later, with the permission of the contractor, oil as a lubricant was entirely eliminated and water under pressure used in its place, and shortly thereafter all traces of oil disappeared.

The contractor agreed to correct the lubrication system so as to permit oil for lubricating purposes to be applied at not to exceed six drops per minute to the line shaft bearings of the pump, thus eliminating the use of an excessive amount of oil as in the past.

In replacing the pump, two lengths of column and shaft were added, thus making a distance of 326′ 10″ to the pump bowls.

The final test of the well and pumping equipment showed that a delivery of more than 500 gallons per minute was received from the well, which amount exceeded the contractor's guarantee.

Water Troubles

The Logan Avenue well when put in operation received its water from both the Niagaran and St. Peter formations. The turbine pump delivered this water to the distribution system much more cheaply than the supply from the main station with its air lift equipment and auxiliary pumping. Consequently, most of the water supply of the city has since been received from this source. It was found, however, that it was causing crenothrix growths in the mains, staining of fixtures and the delivery of water to the consumer which has been discolored at times, and odorous.

The analyses of the water supply from the main station and the Logan Avenue station are very similar and the iron content in either water is not sufficient ordinarily to cause trouble. However, the method of pumping at the main station by air lift equipment and storage in a surface reservoir before repumping to the distribution system aerated the water, driving out free carbon dioxide and hydrogen sulphide, while the water from the Logan Avenue well was delivered to the mains in

practically its original state. Experiments and analyses showed that the iron content in the water alone was not enough to cause the difficulties encountered and that the discoloration of the water was due to iron picked up in transit in the mains. While some of the color is due to iron, the bulk is caused by a carbonate precipitate. Waters as high in carbonates as this water will frequently be deeply colored, even if the iron content is so low that no discoloration would normally be expected. Consequently, in order to correct the existing conditions it was necessary not only to remove the iron but to provide for the release of the CO_2 and other gases and also to control the pH value.

The city council had plans and specifications prepared by its engineers for the installation of suitable equipment for treatment, based on yielding a water with qualities equal to the following:

Iron—0.10 p.p.m. maximum
Free carbon dioxide—5.00 p.p.m. maximum
Hydrogen sulphide—0.00 p.p.m.
Hydrogen ion concentration —7.4 pH minimum.
Total hardness—85.00 p.p.m.

While primarily the aim was to remedy the condition described, in order to provide a satisfactory water, the plans included additional equipment for the softening of the water from the present hardness of 310 p.p.m. to a minimum of 85 p.p.m., which would compare favorably with Lake Michigan water. However, the council rejected bids for softening and decided on the construction of an iron removal plant only, principally because of financial conditions, but also because during portions of the year the city was served by the main stations also, and consequently all the water delivered to the distribution system would not receive the advantages of water softening by a plant installed at the Logan Avenue station.

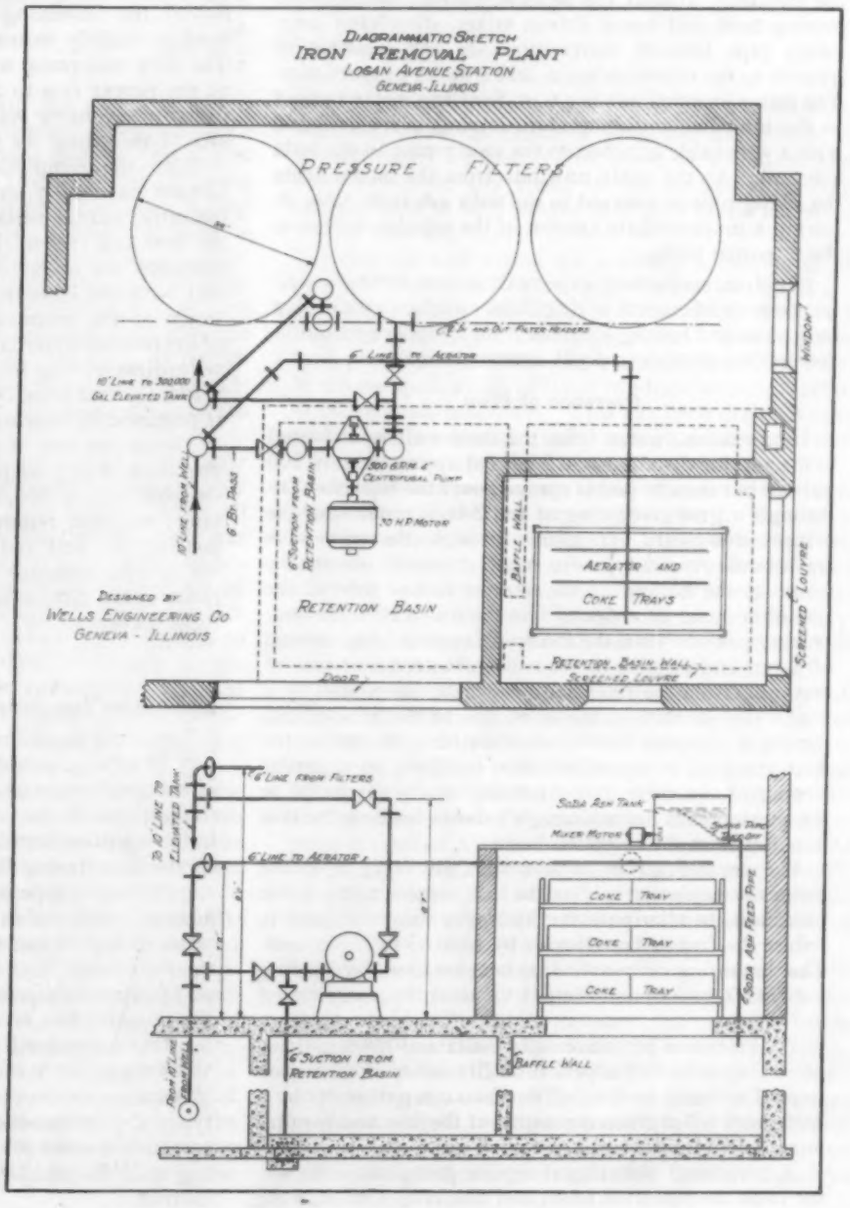
Iron Removal Plant

All equipment is installed in a building erected as an addition to the original Logan Avenue station. Since this station is in a Class A zone residential section, the building is a brick structure trimmed in stone and of the Old English type so as to be in harmony with the homes in the vicinity, and from outside appearances looks like a high-class residence.

The city accepted the proposal submitted by the Graver Tank & Manufacturing Corporation of East Chicago, Indiana, which covered the furnishings and installation of a complete iron removal plant as follows:

(1) A coke tray aerator, comprising a structural steel frame supporting three aerator trays, each 5 ft. 0 in. by 8 ft. 0 in. and of 8 in. effective depth, and each containing 26 2/3 cubic feet of coke graded to 1½ in. size. The bottom of each tray is of square mesh copper screen supporting the coke. Thus the total area of trays is 120 square feet and the total volume of coke is 80 cubic feet. The inlet to the distributor piping is equipped with a float valve operated by a float in the retention basin. The aerator is provided with a chute or apron which diverts the water from the aerator to one side of the retention basin.

(2) A horizontal centrifugal pump direct connected to a 30 h.p. 1750 r.p.m. electric motor, with an automatic starting equipment controlled either manually or by a float switch in the retention basin. The pump was made by The American Well Works of Aurora, Illinois, and is 4 in. by 4 in. double suction, bronze fitted, designed to deliver 500 gallons per minute against a total head of 160 feet. The motor is General Electric.



(3) A battery of three 96-in. diameter pressure filters, each designed for a working pressure of 100 pounds per square inch and complete with valve nest of 5 valves per filter, air piping, pressure gauges, etc., contains the filtering medium of crushed quartz 24 in. deep supported on silica gravel. The quartz is in three layers of varying size as follows: a six-inch layer of coarse quartz, all passing a 0.18 in. opening sieve with 98 per cent retained on a 0.0164 in. opening sieve; a six-inch layer of medium quartz, all passing a 0.131 in. opening sieve with 98 per cent retained on a 0.0164 in. opening sieve; and a 12-in. layer of fine quartz, all passing a 0.046 in. opening sieve and 98 per cent retained on a 0.0116 in. opening sieve. The supporting gravel is in three layers of 4 in. thickness each, as follows: coarse ¾ in. to 1½ in.; medium ⅜ in. to ¾ in.; and fine ¼ in. to ⅜ in. The gravel is supported on a steel strainer plate with stainless steel strainers.

(4) Soda ash feed equipment mounted on the top of the enclosure around the aerator, and consisting of a mixing tank and motor driven mixer, dissolving tray, swing pipe take-off delivering soda ash solution by gravity to the retention basin, and a meter proportioner. The meter proportioner is a 6 in. Sparling meter located in the inlet line to the aerator, driving a drum wound with a wire cable attached to the swing pipe in the soda ash tank. As the cable unwinds from the meter drum the swing pipe is lowered in the soda ash tank, thus allowing a proportionate amount of the solution to flow to the retention basin.

(5) Interconnecting pipe, valves and fittings, electric power and control wiring, float switches, rate of flow indicators and testing equipment for hydrogen sulphide, free carbon dioxide and pH determinations.

Operation of Plant

In operation, water from the deep well is delivered to the aerator distributor at a rate of approximately 500 gallons per minute and is sprayed over the top coke tray through a grid consisting of ten 2-inch pipes with the orifices downward, trickling through the successive trays to the retention basin. A metal trough diverts the water at the bottom of the aerator to one side of the retention basin in order to minimize short circuit flow. During periods when the filters are approaching the end of a run and require backwashing, the reduced rate of pumping from the retention basin is compensated by a float valve located in the inlet line to the aerator. As the depth of water in the retention basin increases, the float attached to the valve rises, resulting in a partial closing of the valve and throttling of the discharge to the aerator, thus maintaining a balance between the flow into and from the retention basin.

The aerator serves to add sufficient oxygen to the water to completely oxidize the iron content to the ferric condition, to eliminate the hydrogen sulphide, and to reduce the free carbon dioxide by from 65 to 75 per cent. The remaining carbon dioxide is neutralized by feeding soda ash solution, and the pH value of the water raised to 7.8-8.0.

The retention basin normally contains 10,000 gallons, providing a retention period of 20 minutes for reaction time. The basin is divided into two compartments by a baffle wall to lengthen the course of the flow and to minimize short circuit flow.

A horizontal centrifugal service pump takes the water from the retention basin and discharges through the filter battery to the 300,000-gallon elevated storage tank located on the property at the rear of the filter plant. The iron precipitated by the aertion treatment is removed by the filters, the filter effluent rarely showing more than a trace of iron.

The piping is arranged to provide bypass connections by means of which the aerator and retention basin may be cut out of service for changing coke or cleaning, the balance of the equipment remaining in operation, or the entire plant may be cut out of service and the discharge from the deep well delivered to the service pump, thence directly to the elevated storage tank.

The back wash water for the filters is taken from the elevated storage and is discharged to a concrete sump provided with a drain to waste, the wash rate being manually controlled by means of a throttling valve and rate-of-flow indicators.

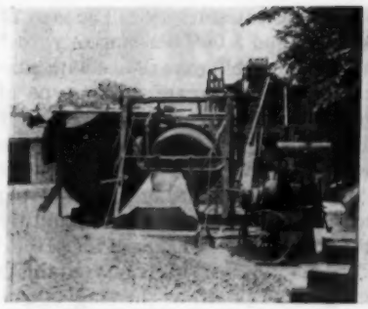
Following the installation and placing in operation of the iron removal equipment, the deep well pump was taken from the well and four of the fifteen stages removed, the remaining eleven stages being reduced in head by slightly reducing the diameter of the impellers. The deep well pump was thus adjusted to deliver water at the proper rate to the aerator and under the proper pressure, avoiding waste of power through any necessity of throttling the pump.

With the completion of the iron removal plant, Geneva has finally secured a water supply adequate in quantity and of suitable quality, and has eliminated the iron and crenothrix nuisance. The water treatment processes are susceptible of great precision of control, and with the laboratory facilities provided for supervision of the operation of the equipment, the quality of the treated water is maintained at uniform excellence regardless of varying quality of raw water or of demand. Control tests are made at least daily, and oftener if required by varying conditions.

The entire cost of the water supply, which includes the deep well; deep well pumping machinery and switchboard; a 300,000-gallon elevated steel storage tank; the iron removal equipment; and the building housing the well and filter equipment, was paid from the surplus earnings of the Water and Light Department of the city, obtained from the sale of water and light service.

Cast Iron for Sewer Connections in Maryland

Upon organization, the Washington Suburban Sanitary District acquired control of approximately 55 miles of existing sewers with approximately 1630 sewer house connections. In the construction of new sewer lines and in the maintenance of the existing sewer lines and house connections during the past 14 years, observations with regard to the type of pipes and fittings used and the methods employed in construction of approximately 160 miles of sewers and 8700 house connections have led to the conclusion "that a sewer house connection constructed of cast-iron pipe and fittings from the main sewer to the property line or through to the house with joints of leadite, mineralead, sulphur compound and lead, provides a cheaper service in first cost, at least as durable, if not more so, than can be secured with any of the other types of pipe commonly used for this purpose, and most certainly a service lower in maintenance cost," according to H. Roland Devilbiss, department engineer of the district.



Municipal asphalt mixing plant.

Cold patching of gutters.

Placing binder course on old concrete pavement.

Pre-Mixed Resurfacing Both Satisfactory and Cheap

By Wm. W. Reeder

REDUCED budgets, during the past few years, have caused many an harassed municipal engineer to seek new and cheaper methods of highway maintenance. Upper Darby Township, in Delaware County, Pennsylvania, has been fortunate in changing its method of resurfacing to one not only cheaper in first cost, but which is structurally more satisfactory. This township has, as part of its highway system, sixty miles of bituminous macadam construction. It has been found that, aside from the cold patching of minor defects and shoulders, an annual program of 30,000 square yards of resurfacing and 40,000 square yards of surface treatment are required to properly maintain these highways.

The usual method of resurfacing had been, after scarifying and reshaping, to prime the base and apply a two-course penetration top of three inches. As in all penetration work, the quality of the finished work was entirely dependent upon the distributor's ability to lay evenly the specified gallonage per yard. Spreading of the two courses of stone, each to a uniform depth, also presented an opportunity for careless workmanship to produce an inferior wearing surface. The lack of uniformity obtained by the above method was the real cause for its abandonment; the reduced cost of the method adopted being an unexpected and most welcome surprise.

The present method consists of applying to a scarified, reshaped, and thoroughly compacted base, two courses, totalling two inches, of pre-mixed bituminous concrete; the asphaltic cement, mineral aggregate, plant inspection, and method of laying being in accordance with the Pennsylvania State Highway Department Bituminous Surface Course Specification "E," as revised October 25, 1932. A light dusting of screenings is applied and broomed in to the finished surface to seal any remaining voids. The cost of the complete operation has run between $.54 and $.57 per square yard.

The municipal mixing plant is of the pugmill type with conveyor to an overhead storage bin. The cost of mixing at this plant is less than the price at which the pre-mixed material can be bought elsewhere, but the quantities required are larger than the capacity of the plant. The mixed material is, therefore, purchased by contract, which for 1933 is $4.00 per ton F.O.B. the manufacturer's plant. This plant is within a four-mile radius of any street in the municipality. The stone used is of such weight as to give about ten square yards to the ton.

There are also within the township a number of old concrete roads which were built without reinforcing or expansion joints, and which had cracked badly due to this fact and to poor base preparation. It was discovered that these cracked concrete roads made an excellent base upon which to lay a two-inch wearing surface of bituminous macadam. This has been done satisfactorily upon roads with grades as high as eight per cent. The cost has averaged $.54 per square yard.

Experiments were made using a material prepared by mixing the crushed stone aggregate by immersion in an emulsion of bitumen. The ultimate surface was quite satisfactory, but it was noted that unless a "quick breaking" emulsion was used, the final compacting of the surface could not take place until two or three days after the material had been placed. The immersion process is somewhat cheaper than mixing.

During the past year about six thousand square yards of new roads have been constructed using a pre-mixed surface. A six-inch base of quarry spalls is first laid and the voids filled with crushed traprock graded from ¾" to 1½" and bound with screenings. After this base has been thoroughly compacted, the pre-mixed material is applied the same as in a resurfacing job. As the materials for the base were bought at an unusually low price, comparison of costs with similar work would be unfair. This type of construction should cost in the neighborhood of $1.30 per square yard.

Eight hundred tons of material are used yearly patching potholes and widening shoulders. This material is mixed at the municipal plant, using about twelve gallons of emulsified asphalt to the ton. While traprock is used for all other work, ½" limestone is used for patching material. This is done with the idea that the limestone will crush just enough to fill the hole and make a tight bond with the old surface. Many patches in the past failed owing to neglecting the thorough dry-

ing of the hole to be patched. When mixing the material with an emulsion, this process is not so necessary.

For winter patching, the material is mixed with a cut-back asphalt and the hole is dried with a torch.

The 40,000 square yards of surface treatment completed annually consists of spreading one-third of a gallon to the yard at 300°F. of an asphalt having a penetration of 165; the percentage of total bitumen soluble in 86° naphtha being not less than 76%. Upon this is spread with a mechanical spreader about thirty pounds of crushed traprock to the square yard. The road is then thoroughly rolled with a ten-ton roller. The only part of this proceeding worthy of note, is the fact that the Pennsylvania State Highway Department specifies ¾" stone for this type of work, while we have found ½" stone to be more satisfactory. The cost of this type of work has averaged $.089 per square yard.*

The writer has had considerable experience with pre-mixed surfaces using a slag aggregate. This type of construction is quite satisfactory for light vehicular traffic, and some of these roads have been in use ten years without further treatment. The chief advantage in using a slag is the increased yardage secured per ton due to the lighter weight of the aggregate, and the fact that this type of surface is self-healing for several years after laying. This type of surface contains a much higher percentage of asphalt, as the slag aggregate is porous; hence its self-healing ability.

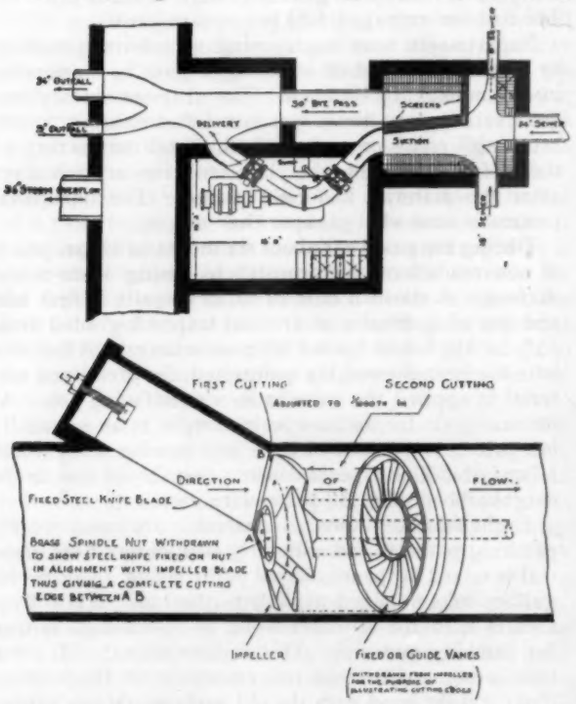
*During July and August we did 6,000 to 10,000 sq. yd. daily at a total cost of 4.5c for material and 1.1 ct. for labor.

Disintegrating Sewage for Ocean Dilution

BOURNEMOUTH, England, is a seashore resort which discharged about six million gallons a day of untreated sewage through five groups of outfalls along seven miles of bathing beach, the outfalls being carried 2,000 ft. beyond high water mark and discharging into about 40ft. of water. During certain winds, solids were carried back to the shore.

To eliminate or at least greatly ameliorate this condition it was decided to break up the solids before discharge, and for this purpose a "disintegrator" was installed at one of the outfalls, and this proved so successful that similar ones have been installed at the other outfalls also. This, believed by H. R. Homewood, assistant engineer of Bournemouth, to be the first disintegrator to be installed anywhere, was described by him in a paper before the Institution of Municipal and County Engineers on July 29th, from which paper this information is obtained.

The disintegrator is shown by the accompanying drawing. The cutting action is of a scissor or shearing nature. There are two stages of cutting, the first between a fixed steel knife blade and revolving blades or impeller, the second between the impeller blades and a set of fixed or guide vanes beyond them.



Arrangement of cutters in disintegrator. Above—Plan, showing disintegrator with motor, screens, by-pass, etc.

Difficulties were at first experienced by rags getting entwined around the blades and ultimately stopping the machinery, but this has been completely overcome by a slight variation in the design of the blade. However, if the blades cease revolving or slow down too much, this clogging occurs and has to be removed by hand before they can be started again.

The greatest difficulty was with stones and other large mineral matters which did much damage to the blades; but this has been overcome by allowing the sewage to fall into a metal basket screen, which is cleaned out daily. Since these changes were made, "the installation has worked perfectly." The impellers are case-hardened and are expected to last a year without resharpening.

The disintegrators are 8 in., 12 in., 15 in., and 18 in. diameter, respectively. The two smaller ones are driven by D. C. motors and the speed is controlled in accordance with the flow by a float in the suction sump; this being necessary since the impellers act as a centrifugal pump. Should the flow during a storm exceed the maximum capacity of the apparatus, the surplus passes directly to the sea through a by-pass, going first through a screen whereby most of the solids are retained to pass through the disintegrator. These screens are liable to become clogged with rags and paper and experiments are being made with mechanical rakes electrically driven and put into operation by a float switch when the sewage rises to a certain level.

The cost of such equipment, including installing it and the necessary chambers, piping, etc., varied from £ 600 to £ 800.

The first noticeable effect of the disintegrators was the disappearance of the hundreds of seagulls which formerly resorted to the outlets. No fouling of the beach now occurs from these outfalls. "The great advantage of disintegration is that in pulverizing the solids the tiny particles are open to the influence of the marine organisms, which in a very short time render them innocuous." During 1932 and up to the present time, 160 samples of sea water have been taken along the shore, of which 34 showed B. coli in 10 cc, 14 in 0.1 cc, and none in lower dilutions.

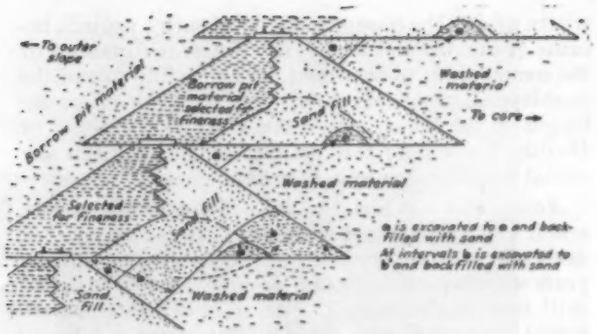
THE WATER WHEEL

FOLLOWING are the essential features of the important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted. Published every month to include articles appearing during the preceding month.

An ideal core-type dam "probably would be one designed with a clay core, contained in and stabilized by masses of granular material whose particles range in size from fine sands adjoining the core to rocks up to several cubic feet in volume as the outsides of the dam are approached," says E. McD. Moore.[6] "The clay core would afford watertightness. . . . The fine sands adjoining the core would afford free drainage to the water freed by the consolidation of the core . . . and prevent the escape of any of the core material itself. . . . The large-sized materials in the outer parts of the dam stabilize the entire structure." A method of construction using trestles is shown by the sketch (the trestles themselves not being shown). The trestles are placed just outside the outer limits of the pool on each side. The first materials dumped are, on the pool side, a free-draining bank sand and, on the outside the most impermeable type of borrowpit material obtainable. At intervals of 200 to 300 ft. sand fills are built tied into the longitudinal sand fill and extending beyond the toes of the dam, to serve as drains. If the beach material is free draining, these sand drains need not be carried higher than 10 to 15 feet; if it is not, they should be carried up to the top of the dam.

Corrosiveness of water of four Maryland well supplies was practically eliminated by aeration, which effectively reduced the free CO_2 content, followed by lime at the rate of 0.75 to 1.0 grain per gallon to raise the pH to 8.0 or more.[12] The pH of the raw waters in these four supplies ranged from 4.2 to 5.9; after treatment the pH ranged from 6.9 to 8.8 at the plant, and 6.8 to 8.5 at points in the distribution system. The CO_2 of the raw waters varied from 28 to 11 p.p.m., and in the distribution system from 0 to 5.0, seldom exceeding 1.0. In all four of these plants flat trays containing holes were used for aeration, two of them with and two without coke. The former were spaced 12″ apart vertically; the latter 9″ clear with 10″ coke. The area of the trays in the two former gave 17 and 19 g.p.m. per sq. ft., respectively, and in the latter 30 and 19 g.p.m. "Simple and practicable units of measurement in the initiation of such a program and in its continued control are available in tests for dissolved oxygen, pH, and carbon dioxide."

Costs of purification in a typical Illinois plant total but 12% of the operating expenses,[14] or 2.42% of the total cost of furnishing water including overhead. The cost per million gallons for a typical plant would be: Alum, $2.68; ammonia, $0.25; chlorine, $0.23; act. carbon, $1.40; wash water, $0.28. On the basis of total cost of furnishing water, the alum costs 1.33%, carbon 0.7%.



From Engineering News-Record, Aug. 24

Sketch showing method of constructing core-type dam

"One of the most frequently practiced false economies is in the use of wash water. . . . Not so long ago we were taught that it was wrong to wash a filter too clean. . . . There is no such thing as a too-clean filter bed."

"The most recent cost is activated carbon. . . . It is said that the average citizen is quite oblivious to the water system which serves him except when two things happen —a disagreeable taste appears and when he gets his bill. We may not be able to help the latter difficulty, but if we are skillful in the use of carbon we should be able to prevent the first."

A decrease of overall pumping efficiency from 80% to 60% means a loss in the average plant of $4 a million gallons—nearly as much as the operating costs of purification. "Many a plant is paying dearly for the use of obsolete equipment."

Color up to 900 p.p.m. was reached during the drouth of 1930 by the water supply of Elizabeth City, N. C., although generally it ranged between 150 and 550.[11] This is believed to be due largely to organic-bound iron. The color was reduced from 550 to 10 p.p.m. by double coagulation (chlorinated copperas plus chlorine at the influent end of the mixing chamber, and alum and lime at the half-way point); but the negligible turbidity of the raw water caused the floc to settle so slowly that the plant could not operate at more than 75% of its capacity, and the settled floc tended to disintegrate suddenly after standing in the coagulating basin 7 to 21 days, renewing the color. When the color exceeded 550 this process did not remove it; iron in the form of soluble organic ferric iron passed through the entire plant. After experimenting, the following treatment was adopted: At the influent end of the mixing chamber add sufficient lime to give a pH value of 8.8—9.8; 0.25 grain of potassium permanganate per gallon was added; and chlorinated copperas and alum at the half-way point. At pH 8.8 the permanganate most effectively causes the organic iron to assume the colloidal state and precipitate, and also precipitates any hydrogen sulphide present. There is no return of color, a rapidly settling precipitate was formed which permitted the plant to operate efficiently at 90 to 95% of its maximum capacity. The coagulated material showed little tendency to disintegrate. These results are "not accomplished by any other group of coagulants." The process is "economical and practical."

A national distribution system has been proposed for England,[28] the idea being that the entire country be "covered with a network of mains from which water could be drawn at any point, on the analogy of the elec-

tricity grid." The impracticability of such a project, because of the cost and the greatly different elevations of the communities to be served (to name only two of the most immediate evident objections), is explained at some length in the latest annual report of the Ministry of Health. We wonder that the idea should be given any official consideration by a national bureau.

An ink well was found by R. M. Bagg at Milwaukee, a well which discharged what analyzed as true ink.[18] A deep well at a tannery which had been in use for many years was deepened to obtain a better supply and on the drill breaking through a crust at 1600 feet black ink flowed for several days. This was explained as follows: "Close to the casing wall a tannic acid pipe line was located and during the years had sprung a leak, permitting the tanning chemicals to trickle down along the casing wall. Since the water ran very high in both iron and lime it had formed this ink, and it had slowly settled down into the cavity at the bottom of the well. This crusted over and thus the ink was preserved until we broke through the cover of the cavern when sinking deeper."

Back-siphonage through flush valves is a possible source of contamination of a water supply. This was demonstrated at the University of Illinois[10] it being shown that "if a closet bowl should be filled to above the flush rim by clogging of the outlet, or if the closet should have a low spud (hat is, if the discharge from the flush valve enters the closet below the normal water level), the contents of the water closet will be drawn into the water supply line whenever a small vacuum in the water pipe occurs." Closets with low spud should be equipped with some positive device for prevention of back-siphonage. Closets built for top spuds are not likely to back-siphon, but "the latest type of flush valves with siphon prevention accessories should be selected."

Chlamydomonas in storage reservoirs, a rather unusual form of organism to trouble water superintendents, were found to be very annoying in Easton, Pa., last summer. [17]They gave little taste or odor, but gave a green color to the water, which left green rings or sediment in glasses, bowls, etc., and a green scum on boiled water. Also they consume chlorine, so that, unless the chlorine dose is increased, aftergroths of bacteria result. They were finally destroyed by copper sulphate, but not until 10.5 pounds per million gallons was applied, 5.5 at the pumping station and 5.0 directly to the reservoirs. From this experience, Thomas and Burger concluded that: 1—Chlamydomonas can cause serious storage reservoir trouble by (a) unpleasant color and turbidity, and (b) by increasing the chlorine demand of the water. 2—It may assume a variety of forms in its life cycle. 3—At times it may cling to reservoir walls, at other times be dispersed through the water. These growth phases require different methods of treatment. 4—This organism can resist copper sulphate treatment up to 8 pounds per million gallons.

Water softening plants for small cities may cost 50 to 100 per cent more per capita than for large ones, but even so be worth while even from a financial point of view only. [16]Thus, a plant for a large city may be built for $40,000 per million gallons, or $4 per capita. But a plant for a city of 4,000 would probably cost $60,000 per million gallons, and if operated only 12 hours a day would need to be of double capacity, costing $120,000 per million gallons actually treated; while on the other hand the consumption might not exceed 60 gallons per capita, giving a cost of $7.20 per capita. Where chemical precipitation and filtration are necessary for removing iron or other matters from a water, little or no additional plant is needed for softening and the treatment cost would not be increased more than 10 to 15%. The operating cost of softening a water of 17 grains per gallon total hardness down to 3 grains by the excess lime and recarbonation method would cost approximately $28 per million gallons, or 0.28 ct. to 0.17 ct. per capita per day, or from $1.00 to 62 cts. per year. Assuming that soap is used with an average of 1.2 gallon per capita per day and costs 12 cts. per pound, the saving in cost per year for soap would be $2.47 per capita, or a net saving of $1.47 to $1.85 to cover the capital charges.

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August 24

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Thirty foot mechanical finisher on asphalt pavement in Contra Costa County.

California Pavement Records and Construction Progress

By Earl Withycombe

Assistant Construction Engineer

Asphalt Concrete Records

THE 1931 record for tonnage production was made on Contract 25FC6-25EC3 by the Peninsula Paving Co. in San Luis Obispo County, between Paso Robles and northerly boundary, where the average daily output was 1117.3 tons. T. W. Voss was resident engineer and J. M. Chaffee, street assistant. Contract 26FC2 in Fresno County, Goshen to Kingsbury, Union Paving Company, was a close second, with 1025.3 tons average output. H. B. La Forge was resident engineer, L. J. Low, street assistant.

In 1932, the California record for asphalt pavement production was made on Contract 46CN1, in Fresno County, between Fancher Creek and Fresno, Union Paving Company, contractor, where 1317.7 tons were averaged per eight-hour day. H. B. La Forge was resident engineer, with L. J. Low, street assistant.

Stability of asphalt mixtures was emphasized during 1931, the record being made on Contract 48CS1, in Imperial County, East Highline Canal to Sand Hills, Griffith Company, contractor, with E. A. Wolfe, resident engineer. The average stability was 3993 pounds for surface mixture. During 1932, maximum surface stability of 3152 pounds was obtained on Contract 47VC5, at Fullerton in Orange County; Oswald Bros., contractor, and R. D. Kinsey, resident engineer.

The maximum density of asphalt mixture during 1931 was 97 per cent on Contract 28FC5, in Imperial County, Arroyo Salada to northerly boundary, R. E. Hazard Co., contractor, with H. O. Ragan, resident engineer. The 1932 density record was 97.5% on Contract 47VC4, at Glendora; Oswald Bros., contractor, L. R. McNeeley, resident engineer.

Bituminous Smoothness Record

The record for smoothness during 1931 was made on Contract 26FC2, Goshen to Kingsburg, Fresno County, where 11.5 inches per mile was obtained; Union Paving Company, contractor; H. B. La Forge, resident engineer. During 1932, two projects made approximately equivalent smoothness records. Contract 46NC1, Fancher Creek to Fresno County, registered 10.3 inches per mile, Union Paving Co., contractor, and H. B. La Forge, resident engineer; Contract 47VC5, at Fullerton, Orange County, had 10.5 inches per mile; Oswald Bros., contractor; R. D. Kinsey, resident engineer.

Asphalt Concrete Pavement Construction

During 1931, the average daily output of asphalt concrete mixtures was 624.9 tons, while two projects, Contracts 26FC2 in Fresno County and 25FC6-25EC3 in San Luis Obispo County, averaged 1025.3 tons and 1117.3 tons respectively per eight-hour day. On four projects, two mechanical finishers were used, one for finishing surface and one on base. The average stability of surface mixtures was 3323 pounds, and the average relative specific gravity or density was 93.8 per cent. The average surface smoothness of asphalt pavements was 17.5 inches per mile.

During 1932, the largest single project was in Im-

perial County, 14.7 miles between Coyote Wells and Dixieland, involving 64,950 tons of mixture, and an average output of 683.7 tons per day. The average daily tonnage of mixture laid for all projects was 614 tons. The average stability of surface mixtures was 2683 pounds, and the average relative specific gravity was 94.3 per cent. The average surface smoothness 11.8 inches per mile.

In designing asphalt concrete mixtures, the Hubbard-Field stability test, applied to the mortar portion of mixtures to determine the resistance to displacement, continued to control, and surface mixes with dust contents of 22-25 per cent of the total mixture passing the 10-mesh sieve were used. It has been found that this mixture is less susceptible to pushing and rolling under present-day traffic conditions, and also retains its nonskid qualities for a longer period of time.

Automatic Proportioners

Production plants have been made more efficient by improved methods of feeding, greater storage capacity of heated aggregate, quicker discharge gates, and automatic timing devices. On one project, the proportioning device, which was operated by hydraulic jacks powered by electric motors, opens one gate and holds it open until the set weight is deposited in the weight box, then closes the first gate and opens the second gate in predetermined order. Four separate mixes may be set up at one time, and mixes can be changed by means of a selective switch. An average output of 970 tons per day for 44 days, with 2½-ton batches, was turned out with this plant, operated by Hanrahan Company in San Luis Obispo County.

Spreader boxes were in general use to distribute the truck loads of mixture, and mechanical finishers with various improvements which have been made since their inception in 1927. The rake design was improved by changing the motion to a direct fore and aft movement which gives a combing action to the mix. A traveling track arrangement was used by the Hazard Company on Contract 28FC5 in Imperial County, which eliminates the necessity of carrying track ahead.

A caterpillar tread has been used on finishers, running outside the side forms, with the screeds riding on the forms. Greater surface smoothness is being obtained by initial cross-rolling with tandem roller instead of diagonal or half-circle rolling, this method covering the entire surface better, the roller turning being done off the pavement. The resulting smoothness approximates that of portland cement surfaces.

Mixture Design

In the design of asphalt mixtures, it has been found that with most aggregates, increasing the percentage of crushed particles in the material passing No. 10 mesh increases stability. Many local materials which would otherwise have to be rejected for lack of stability are made acceptable with the addition of crushed sand, resulting in a considerable saving to the State.

The results obtained to date in mixtures controlled by stability tests indicate that this method is the most valuable development in the art of design and control of mixtures that has been brought forth in the last decade. Pavements so controlled have shown a marked uniformity and improvement in performance.

Finishing

The development of the finishing machine was likewise the greatest advance in the technique of laying smooth riding pavements. The roughness imparted to the pavement from irregularities in the side forms is something that cannot be removed with the machine. To eliminate this feature, experimental methods of screeding behind the finishing machine are in progress. One method is that of floating transversely behind the finishing machine with the 16′ one-man float which was developed for cement concrete. A second method consists of a multiple-section long wooden drag drawn by the finishing machine. This device was first used by Los Angeles County on similar work and their results are very favorable.

Oil Surfaced Roads

During 1931 and 1932, the trend toward the bituminous treatment of rock surfaced roads has been continued.

Materials for oil mixtures are selected prior to the letting of contracts on the basis of their soundness, respective stabilities, and resistance to disintegration of the completed mix by water.

Field control is checked at regular intervals by stability tests made on the completed mix as submitted to the laboratory. No existing devices for measuring stabilities of mixtures with lighter oils were available, and the Hveem plastometer was developed in the laboratory for this purpose. In this machine the lateral resistance to deformation with load on a compacted cylinder is measured. The results of the plastometer indicate the probable performance of the mixture under traffic.

The effect of water on the aggregates in the completed mix is determined by the swell test. A compacted cylinder is immersed in water and the resulting change in volume of the specimen is recorded in percentage of swell, which indicates the performance of the mixture under the conditions of weathering.

The probable effect of rain water in separating the oil from the aggregates is indicated by first mixing a sample of the dry aggregates with the oil and then adding water and stirring to determine the percentage of separation that results after the water has thoroughly soaked the mixture.

Oil contents are set from a series of curves relating oil to surface area as determined by a grading analysis; the individual curve for any material being selected by laboratory tests in advance of field design.

Finishing

Some improvement was made in the manner of finishing oil mixtures during the past season. It was found desirable to hold in reserve a small amount of uncompressed material, in order to feed it in during the blading and rolling of the finished road surface. This method has been instrumental in improving the riding qualities of this type of road.

The so-called slurry type base course has become standard practice where crushed material must be provided for base for oil mixtures. Where suitable cementing material is available locally, it is applied direct without crushing, and processed in place. Comparative roughness shows that care in preparing the base is reflected in the riding qualities of the completed oil mix.

This is the second of two articles dealing with California pavement records and methods. The first appeared in the August issue. They were prepared from material appearing in California Highways and Public Works, official publication of the California Highway Department.

The Sewerage System of Tokyo, Japan

By Isador W. Mendelsohn

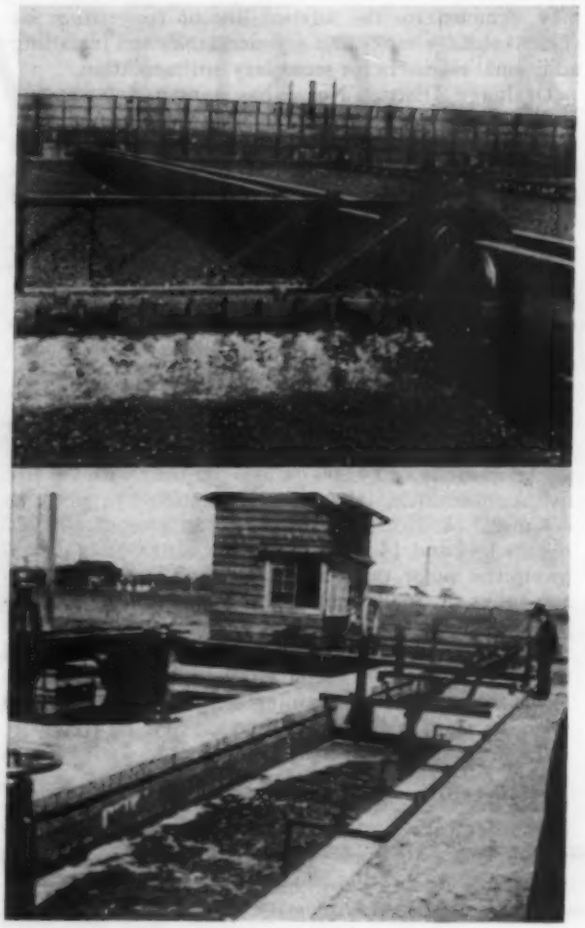
TOKYO, the capital of the Japanese Empire and third largest city of the world, is situated at the head of Tokyo bay in the center of the eastern coast of Hondo, the main island, and is 18 miles inland from Yokohama. It contains over four thousand industrial establishments with such products as toys, curios, toiletries, silks, embroideries, etc. Modern Tokyo dates back only to the tremendous reconstruction activities resulting from the destruction of dwellings of almost half the metropolitan area in the great earthquake of 1923. The old, narrow and muddy roads were replaced by wide paved streets, the thousands of burned dwellings by buildings of concrete. The 1930 census gave the population as 2,070,520. On October 1, 1932, the city incorporated 82 adjacent precincts and towns, becoming Greater Tokyo with a population of 4,986,000 and an area of approximately 225 square miles.

From the time of its foundation centuries ago the city had open street drains discharging surface and waste waters into castle moats, canals, and rivers. As the population increased, these drains became foul and offensive. In 1876 an epidemic of cholera broke out as a result of these conditions, and the fear-stricken public finally prevailed upon the authorities to provide suitable water and sewerage facilities. Waterworks improvements were completed in 1898, and in 1908 plans for sewerage were authorized by the municipality with the approval of the Imperial Government, and work on them was begun in 1911 and has been continued since, although halted frequently by large fires and the earthquake of 1923. During the period 1911-1929, about 50 per cent of the sewerage scheme was completed at a cost of about 70,000,000 yen (about $35,000,000). It is expected that the final sewage disposal works will be ready in 1939.

The total drainage area of the Metropolitan District (approximately 32 square miles) is divided into three sections according to topographical conditions. Drainage District No. 1 is subdivided into high, middle, and low-level sections and serves all of 10 city wards and parts of two others, including the civic center of Tokyo.

The sewerage system is of the combined type, except in certain sections where topographic features necessitate separate sewers. They are designed to carry half of the estimated 45 gallons of sewage per capita per day discharged in an eight-hour period and the run-off from a maximum rate of two inches of rainfall in one hour. For sizes of pipe less than 18″ in diameter, vitrified sewers are used; from 18″ to 54″, precast reinforced concrete pipes are used; and for larger sizes fieldcast concrete shapes.

In Drainage District No. 1, the sewage flows by gravity from the high and middle-level sections to the Shibaura treatment plant in the extreme southwestern part of Tokyo, and is pumped from the low-level section. In 1926 this sewage treatment plant consisted of



TOP—*Mikawashima sewage treatment plant. Travelling distributor on a trickling filter. Part of the tall wire screen shown in the background.* BOTTOM—*One of the two experimental activated sludge plants using diffused air.*

a 3-inch bar screen, two hopper-bottom grit chambers with mechanically cleaned 1½″ Syracuse bar screens and removal of screenings to small trucks on rails, pump houses and chlorinators, two plain sedimentation basins with sloping bottoms operated on the fill and draw system, and regulating gates on the outflow channel to prevent tidal water from entering the plant.

Three 150′ square by 12′ side-water depth clarifiers are being built with six centrifugal pumps to handle the sludge from four clarifiers. They are provided with type S. P. Dorr clarifiers. The three clarifiers are for the present dry-weather flow of 1100 gallons per second. When this flow reaches 1950 gallons per second, the fourth clarifier is to be installed. Three storage tanks are being provided to hold the clarified effluent during the incoming tide, from which it will be pumped by large centrifugal pumps when the tide recedes. The pumps have a capacity up to three times the dry weather flow, the storm water in excess of this being by-passed into Shinagawa bay. An additional sludge storage tank is also under construction. Space is provided for extensions to serve a population of 1,800,000.

The present construction program provides work for many unemployed laborers and is being carried out by the city sewerage department. To prepare for future additions, experiments are now being conducted which

may demonstrate the advisability of converting the effluent storage tanks into aeration tanks and installing additional clarifiers for secondary sedimentation.

Drainage District No. 2 has a main intercepting sewer leading northward to the Mikawashima plant and a storm-water conduit parallel to the sewer to lead the excess rainfall to the Sumida river. The Mikawashima sewage treatment works, located on the upper part of the Sumida river, was put into operation in 1921, the cost of construction exclusive of the pumping station being 4,480,000 yen. The plant treats approximately 19 m.g.d. dry-weather flow in winter and 26 m.g.d. in summer. Ample space is provided for extensions for a total dry-weather flow of sewage of 31 m.g.d. from a population of 600,000.

The works consist of two sets of grit chambers and screens, with bucket conveyors for removing the screenings to small trucks on tracks, pumping equipment with a total capacity of 74,000 gallons per hour with 28′ lift, five sedimentation tanks with a combined capacity of 4.4 m.g., 14 trickling filters with an area of 308,000 square feet and 14 pairs of sewage distributors driven by electric motor, two humus tanks, and two sludge storage tanks of 36,000 cu. ft. capacity each. The filters have a depth of 5.65′ of broken stone varying in size from ½″ to 3½″. Fine wire screens 18′ high surround the trickling filters to keep the psychoda breeding in the stones away from complaining neighbors. The effluent from the plant is discharged into the Sumida river.

In addition, two experimental activated sludge plants are in operation, one, with a capacity of 1.2 m.g.d., using the Sheffield (revolving paddle wheels) system of mechanical agitation, and the other, with a capacity of 0.037 m.g.d., employing diffused air. Sludge from all of the plants is dumped at sea by boats.

Results at the Mikawashima Plant; Percent Reduction

	Average sewage at plant p.p.m.	*Trickling Filters (settled sewage treated)*	*Activated Sludge Experiments (raw sewage treated)* (1) *Mechanical Agitation*	(2) *Air Blowing*
Suspended matter	300	80	85	80
Oxygen absorbed in 4 hours	50	85	90	88
Albuminoid ammonia as N	7	77	80	80
B. coli groups	—	95	98	95

In the mechanical agitation process, decreasing the length of the circulation channels with a reduction of 78 percent in the volume of the aeration tank and shortening the period of aeration from 20 hours to 5, reduced the power consumed by ⅓ without any appreciable effect on the percentages of purification. Preliminary sedimentation of the sewage from four to six hours before activated sludge treatment had no favorable effect on the final result. When part of the activated sludge in the mixed liquid was permitted to settle in the bottom of the aeration tank, the decomposition of the sludge proceeded without any appreciable interference to aeration, thereby decreasing the excess sludge to a considerable extent.

Drainage District No. 3, because of the low elevation of the area included in it, has three pumping stations at which the sewage and storm water are pumped to the Sunamachi treatment plant. Storm-water pumps at these stations are used to discharge into the canals the surface and storm water collected at the time of heavy rainfall and high water-level of the canals.

The Sunamachi sewage treatment plant is located at the mouth of the Shin-Arakawa river, and is designed for a population of 670,000, with a dry-weather flow of 34.5 m.g.d. The plant consists of pumping equipment with a total capacity of 3.8 m.g. per hour with a 21′ lift, four sedimentation tanks with a total capacity of 11.5 m.g., and two storage reservoirs to hold the plant effluent during flood tide. The settled sewage is discharged into the sea at ebb tide.

At present, in the sections of the city where sewers are not available, private collectors remove the night soil from house septic tanks and by means of hand carts and barrels transport it to farms where it is spread over the land for fertilizer. Each householder pays one yen per month for this service.

Tokyo Water System

The first crude waterworks system was installed in 1590, using as source a pond in the western section of the city. About 1650 water was obtained from the Tama river, 24 miles away. After the conflagration in 1871 which wiped out the business section, and the cholera outbreak in 1876, public attention was focused on the importance of a pure water supply, but nothing was done until 1892, part of the program being completed in 1898 and part later. The plan adopted provided for a larger aqueduct, a slow sand filtration plant, and an adequate distribution system. Since then extensions have been made, including the Murayama reservoir with a capacity of 3,300 m.g. completed in 1926 and the Yamaguchi reservoir in 1932. It is planned to commence the construction of a new reservoir in 1933 to be larger than the present reservoirs, and a new slow sand filtration plant, the filtered water to be chlorinated.

At present Tama river water is stored in the reservoirs and is led by gravity to the slow sand filters in the city. Then it is pumped into the distribution system. The distribution system at the beginning of 1929 had 690 miles of water mains and 318,432 water taps, some with meters. The average daily water consumption in 1928 was 100 m.g. and the per capita daily consumption 40 gallons.

Acknowledgment is gratefully made of the assistance of Messrs. Hara, Ebi, and Hitch in the collection of the data in this article.

Improvements in Public Water Supplies in New York State in 1932

Twenty new public water supplies, involving an expenditure of over $11,000,000, were put into operation in various municipalities throughout New York State during 1932. The total number of supplies is now 670 and over 900 communities are served.

Four communities—the city of Albany and the villages of Canastota, Phoenix, and Ticonderoga—abandoned old supplies from polluted or unsatisfactory sources and developed new supplies.

Ten municipalities and districts hitherto without a public water supply developed sources and constructed distribution systems. These include Amawalk-Shenorock District, Shrub Oak-Mohegan District, Thornwood District and Yorktown Heights District in Westchester county; Chenango District, Farnham, Holcomb, Long Lake, North Creek and North Java.

Six other communities built distribution systems and made arrangements for the purchase of water from nearby municipalities or companies, namely, Arlington, Cicero, East Hamburg, Elbridge Village, Elbridge District, and South Farmingdale.

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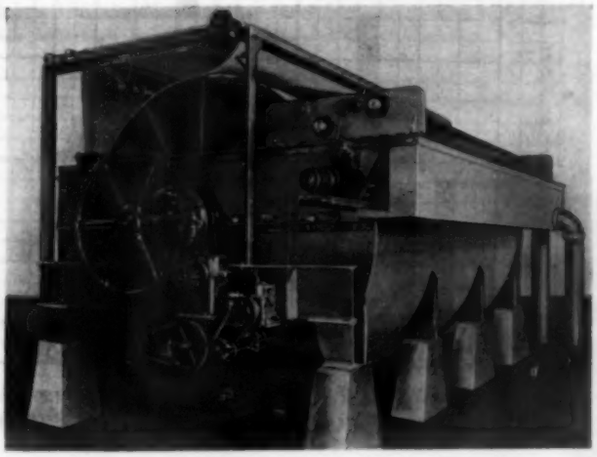

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The Depression And The Water Works

QUESTIONS regarding the effect of the late depression on the operations of water works plants in American municipalities have been answered for us by the superintendents of about 500 plants.

Effect on Water Consumption

Domestic use of water has been less affected, of course, than has industrial or commercial consumption. The tabulation below shows what the experiences of some 400 water works plants have been. Of these, 25 report increase in domestic consumption, and 4 in commercial consumption. Detailed information is as follows:

Domestic Consumption. — Increased, 25; approximately same as previous years, 146; decreases, 4-7%, 43; 8-12%, 86; 13-17%, 28; 18-22%, 27; 23-27%, 14; 28-34%, 10; 35-44%, 4; 45-54%, 1. Totals, increased or remained essentially the same, 171; decreased less than 12%, 129; decreased more than 12%, 84. Total 384.

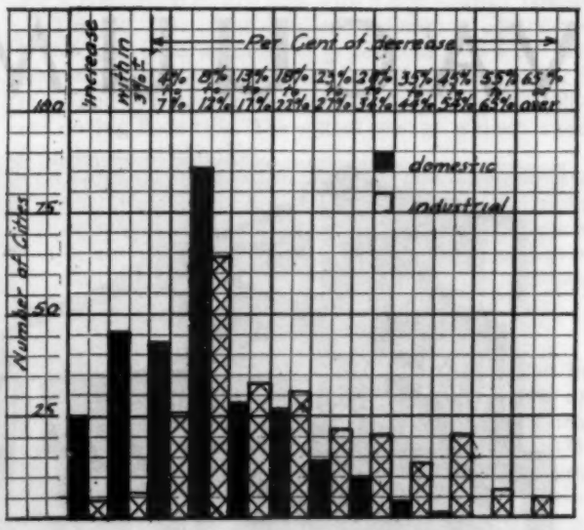
Industrial Consumption. — Increased, 4; approximately same as in previous years, 107; decreased, 4-7%, 26; 8-12%, 64; 13-17%, 33; 18-22%, 31; 23-27%, 22; 28-34%, 21; 35-44%, 13; 45-54%, 21; 55-64%, 7; 65% and over, 5. Totals, increased or remained essentially the same, 111; decreased less than 12%, 90; decreased more than 12%, 153. Total reporting, 354.

Regarding these consumption figures, there were a number of interesting comments. Youngstown, Ohio, reported an industrial consumption only 30% as great as 1930. Many plants report an upturn since early summer, New York City being among this number. Garden City, Kansas, says "the May-June water consumption, as recorded by meters, was the largest in the history of the plant." Another superintendent states "there was a 50% decrease in commercial consumption and 15% in domestic consumption up to the 1st of April; since then we have regained 75% of the loss." Sheboygan, Wisc., says "after a 30% loss in consumption, we were back to normal on May 1." Stoughton, Wisc., reports a decrease of 13% in consumption due, not to the depression, but to the installation of meters.

Effect on Annual Construction Expenditures

The effect of the depression in reducing the expenditures for extensions and new construction is marked, though the analysis given below does not indicate that it has been as severe as is generally thought. This impression is the more pronounced after a careful study of more than 500 questionnaires (others are still being received). Many of the data were not of a nature that could be tabulated readily. Moreover, there was some possibility of ambiguity in replies to certain of the questions. Any replies which were not clear have been excluded from the tabulation; in most of these, it is believed, that the data supplied would have made the tabulation given hereafter appear even more favorable.

Nor are the answers uniform as to a base from which increases or decreases are figured. Many of the replies used the years 1925-1930 as the basis; others, the years 1929 and 1930. However, it is believed that a fairly good picture of the situation has been furnished.



Increases and decreases of domestic and industrial consumption of the past three years as compared with previous consumption; as reported by 400 cities

In regard to 1931 construction expenditures, out of 250 cities giving adequate data, 47 reported increased expenditures; 99 reported expenditures essentially the same as in previous years; 11 reported expenditures approximately within 10% of normal; and 93 reported decreases of more than 10%.

For 1932, 41 cities reported increased expenditures; 72, essentially the same as in previous years; 9, reported expenditures within 10% of previous years; and 106 reported decreases of more than 10%. Detailed figures are given below:

1932.—Increases, 41; essentially the same, 72; decreases, 4-7%, 3; 8-12%, 6; 13-17%, 2; 18-22%, 3; 23-27%, 8; 28-34%, 3; 35-44%, 8; 45-54%, 23; 55-64%, 10; 65-74%, 9; 75-84%, 12; 85-94%, 8; no work at all, 20.

1931.—Increases, 47; essentially the same, 99; decreases, 4-7%, 4; 8-12%, 7; 13-17%, 1; 18-22%, 17; 23-27%, 8; 28-34%, 8; 35-44%, 10; 45-54%, 19; 55-64%, 7; 65-74%, 3; 75-84%, 5; 85-94%, 2; no work at all, 13.

There are many comments, such as the one contributed by Elmira, N. Y., which states that the water works plant of that city had accumulated a reserve fund, and in 1931 spent double the usual amount, and in 1932, three times the usual amount, primarily for unemployment relief work.

Drainage in Georgia for Malaria Control

In 1932 most of the counties of Georgia carried on a more or less extensive anti-malaria campaign, chiefly by draining ponds. The number of ponds drained totaled 745, covering 4,254 acres. This involved excavating 745,400 lineal feet of ditch, of which 38,515 was performed by use of machinery and the balance by hand. Only six of the counties used machinery, four using a ¾ yard drag line and two a ¾ yard shovel. Eighteen cities used prisoners and tax workers on this work, and 23 used this work as a means of relieving unemployment.

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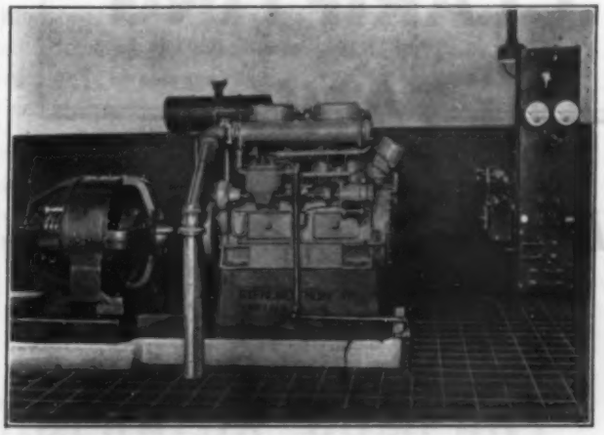

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In view of the floods, both local and widespread, which have visited and every year visit a great many localities, the following instructions by the Ohio Board of Health for disinfecting wells which have been flooded with possibly polluted waters should be read and saved for the emergency when they will prove useful:

The well should be pumped until all the turbid flood water has been removed, after which the cleansing and disinfection processes should be put in operation. In the case of large-diameter dug wells, cleansing can be accomplished by scrubbing the walls with water containing chloride of lime. In dealing with wells of such small diameter that they cannot be entered, about all that can be done is to pour in a strong solution of chloride of lime and let it remain in the well at least for a day before pumping. This process should be repeated if necessary, and before using the water, pumping should continue until it is perfectly clear.

Using Chloride of Lime

Chloride of lime can be bought at most groceries in 12-oz. cans, and can be used in wells with safety. In small-diameter wells one-fourth to one-half pound should be sufficient; but probably a pound will be required in the average large-diameter well.

Best results are obtained by adding sufficient water to the powder (chloride of lime) to make a thick paste, stirring the powder in slowly to avoid formation of lumps; then making a solution by adding the paste to two or three gallons of water, being careful to stir thoroughly while adding the paste. The solution can then be poured into the well.

After the solution has been allowed to remain in the well for a day or more, the water should be pumped out until the chlorine can no longer be tasted. After about a week, samples should be tested by a chemist to determine quality of the water. If the analysis indicates that the contamination persists, dosage with chloride of lime should be repeated.

Protecting Wells

The cover for a dug well should be of water-tight construction, preferably of concrete, to prevent drippings from the pump, or other foreign matter, from entering the well. Pumping equipment should be of such a type, and so installed, that waste water or foreign matter cannot pass through or under the base and enter the well.

When developing a drilled well, care should be taken to seal the annular space between the drop pipe and the casing, to prevent entry at the top of the well of contaminating matter of any kind. If the foregoing precautions are carefully observed, there will not be much difficulty in the maintenance of a safe water supply.

Water Resources Commission for Maryland

"The State of Maryland has established no policy and passed no laws with respect to the conservation, allocation or regulation of water supply uses, either as to priority, purpose, period, place or quantity of use." With few exceptions, there has been no effective regulation of the discharges of the streams of that state, and absence of such regulation has resulted in hazards of flood and of drought. Moreover, no agency exists whose duty it is to review the designing and supervise the constructing of dams.

In view of these conditions, the General Assembly of Maryland in 1931 created a Water Resources Commission "charged with the duty of reviewing the underground and surface resources of the State of Mary-

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In 1931, by order of Court, the Corporation was turned back to the original owners. The Delaware Corporation has been dissolved and the present Company, a Georgia Corporation, styled Nye Odorless Incinerator Company, now owns and controls the entire business, has its headquarters at Macon, Georgia, and the same Officers and Directors who built up the business from the beginning are in charge.

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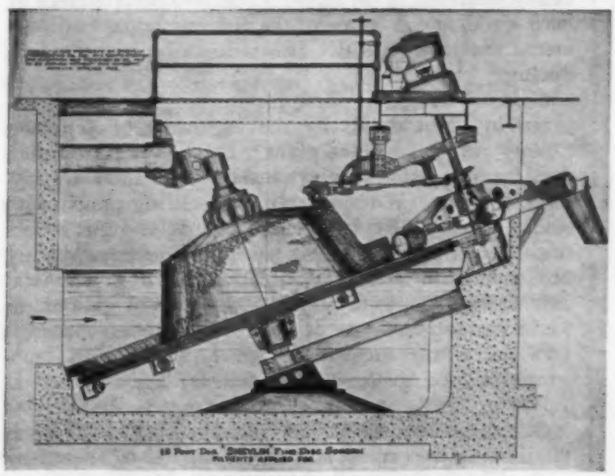

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land and of formulating a plan for the preservation, allocation, control and regulation of such water supply resources for the maximum public benefit, safety and use."

A committee of seven, with Abel Wolman as chairman, was appointed, held its first meeting on Sept. 22nd, 1931, and on Jan. 10th, 1933, submitted its report to the General Assembly, recommending "the creation of a permanent water resources commission of Maryland, with general powers to formulate a water conservation policy, to control the priority, purpose, period, place and quantity of use of water, and to provide for continuity of stream gaging and for the supervision of dams."

The report supports its recommendation by detailed statements of conditions, with tabulated data. These show that 53 public water supplies are taken from the streams of the state, supplying a population of 1,600,000 of which 500,000 live outside the state, mostly in the District of Columbia; the total consumption being about 235,000,000 gallons a day. Some 87 supplies are from underground sources, but these furnish in all only about 14,000,000 gallons a day since they generally serve only the smaller communities.

The only states where control of water resources and structures is practically non-existent, according to the report, are Alabama, Delaware, Georgia, Florida, Louisiana, Maryland, Mississippi, Arkansas, Kentucky, Illinois and Indiana.

The Digestion Tank

(Continued from page 16)

dwellings, apartments, and hotels above certain roomage. "There is no particular reason why sewerage systems should not be placed on the same basis as any other utility, as necessary protective health service is certainly rendered in the construction and maintenance of such works and it is one of the few municipal improvements that can logically be made to be revenue producing.

Costs of treatment plant for Birmingham, Ala., are given in great detail by the engineers of Jefferson County, which built the plant.[4] This plant is designed for 15 m.g.d. capacity and consists of an automatic bar screen, detritor, venturi meter, two settling tanks (with sludge mechanism), two sludge pumps, two gas collection type digestion tanks, gas holder, sludge drying bed, incinerator and administration building. The total cost was $172,696, or $11,513 per million gallons, or $1.15 per capita. Some of the costs of general interest (not including excavation, which varies with topographical and geological conditions) are reported as follows:

Screen mechanism $2,500; incinerator $3,340; meter (indicating, recording and totalizing) $2,673; settling tank reinforced concrete $14,768; clarifier mechanisms $23,700; sludge pumps $2,300; digestion tank reinforced concrete $19,244; digester mechanism $24,500; sludge drying beds—reinforced concrete, slag, sand, underdrains, piping, track and cars—$18,276; gas collection—boiler $1,025; five gas meters $735; hot water circulating pump $125; recording thermometers $300; water meter $185; expansion tank $33; piping, insulation, valves and fittings $4,192; gas holder $2,386.

Measuring sewage by means of a constant-head, variable-orifice meter is effected at Morristown, N. J., by a device designed by Weston Gavett.[3] A circular plate, fitting loosely in a tube, is counterweighted so as to balance dead load of plate and pressure due to the head. Mr. Gavett names as advantages:

1. The loss of head is constant, and may be very small. 0.1 ft. or less. This is of particular value in sewage works, when head is limited.

2. The meter is actuated by difference in head as the orifice is submerged. The water level on both sides may vary without affecting the operation of the meter.

3. The relation between movement of meter and flow is a straight line, unlike weirs, fixed orifices or Venturi meters. This feature permits graphic records from flow meter to be planimetered to give total flow.

4. Movement of plate in tube is practically frictionless. Plate may fit loosely in tube. The annular space between plate and tube provides a constant orifice which gives a minimum flow when none of the orifice in tube is exposed.

5. The range of the meter can be varied by changing the counterweight. The meter may be set for a small flow with light counterweight when a plant is started. Later when a larger capacity is required it may be easily provided by increasing the counterweight.

6. Sewage solids are not deposited in channel such as takes place when weirs are used.

7. The design is well adapted for synchronized flow. The flow of chemicals may be controlled by the main flow meter, or returned sludge and sewage flow meters may be synchronized in activated sludge plants.

8. Where meter is used to measure effluent flow to tidal waters it may be arranged to act as tide valve or check valve by the provision of a plate "S" on top of meter tube as shown in diagram.

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c, Indicates construction article; *n*, note or short article; *t*, technical article.

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24. Brief Sketch of Current Chemical Sewage Treatment. By L. L. Hedgepeth, pp. 42-44.
25. New Developments in the Chlorination of Sewage. By A. E. Griffin, pp. 45-47.
26. Fresh and Stale Sewage. By Willem Rudolfs, pp. 50-54.
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28. New Princeton Sewerage System. By I. Russell Riker, pp. 60-67.
29. Operation of the Freehold Sewage Treatment Plant. By W. J. Schiverea, pp. 68-71.
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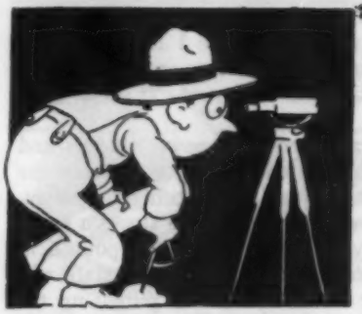

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See pages 47-50 for classified descriptions of latest catalogs

Solving Hydraulic Problems Necessitated by State Highway Location

IN carrying a highway through Pine Creek Gorge, California, the standard adopted of 1,000 feet minimum radius for curves caused the route to cross the creek several times. Two of these crossings, where the creek made a sharp turn, were only 1,900 feet apart. By cutting through the point around which the stream wound and so straightening the channel both crossings could be avoided and the cost of two bridges.

But this cut would have a maximum depth of 75 feet and involve moving 118,000 cu. yd. of earth and rock. The drainage area above this point is about 300 sq. mi. of mountainous territory; and although the stream flow is only a few second-feet most of the year, after spring rains following a winter of heavy snow fall it reaches torrential proportions and rolls huge boulders down the channel. With the shortening of the channel by means of the cut-off and the smoother bed, the velocity here would be even greater than before. One side of the new channel would be formed by the highway embankment, and the danger of undermining of this would be considerable.

This necessitated lining the new channel and making some provision to prevent the stream, as it left this, from underscouring the lining. Plans to amply secure these ends were made and the cost of them estimated and compared with that of the alternative two bridges, showing an apparent saving of about $75,000 by changing the channel, and this plan was accordingly adopted.

The concrete-lined channel varies from 40 to 90 feet wide on the bottom and is 25 feet deep, designed to carry 40,000 c.f.s of water. Concrete 1 foot thick was placed on the bottom and for 16 feet up each side, above which it tapers to a thickness of 6 inches at the top, all heavily reinforced.

The channel was excavated with power shovels and the excavated material hauled in trucks to make the highway embankment. In placing the concrete bottom, standard methods were used; but for the slopes a novel procedure was employed. The concrete was poured in alternate slabs 20 feet across and each slab was smoothed by a heavy screed which was pulled up the slope very slowly by means of a tractor and drum hoist. Two men, riding on this screed, filled concrete in any low places. After being screeded, the surface was trowelled from a bridge, as in pavement construction.

The design of the outlet and of the channel required careful study to provide some method of dissipating the force of the water so as to prevent undercutting of the concrete lining and wing walls. How this was done is described as follows in the official journal of the Department of Public Works by R. C. Myers, assistant engineer of Dist. VII:

"Studies were made of other channels and the methods used in controlling the undercutting action of the water. Much valuable information was obtained from the results of a series of model tests made at the Alden Hydraulic Laboratory of the Worcester Polytechnic Institute, where a model channel was built to scale with one side built of glass in order to better observe the action of the water. Several types of outlets were tested there and the effects on the erosion of the channel noted.

"The type which gave the best result consisted of an outlet which deflected the water upward at an angle of about 12½ degrees. This type produced no appreciable erosion for a distance of 60 feet from the end of the channel. When used on an actual dam spillway, the results were almost exactly as predicted from model experiments.

"The outlet end of the Pine Creek channel change was designed with these results in mind. A heavy cutoff wall was constructed at the end of the concrete lining with a heavy flaring wingwall on each side. The space at the bottoms of the walls was filled with heavy boulders. In addition, three groynes of boulders were constructed at approximately right angles to each wingwall and extending out into the stream to break the back eddy of the water.

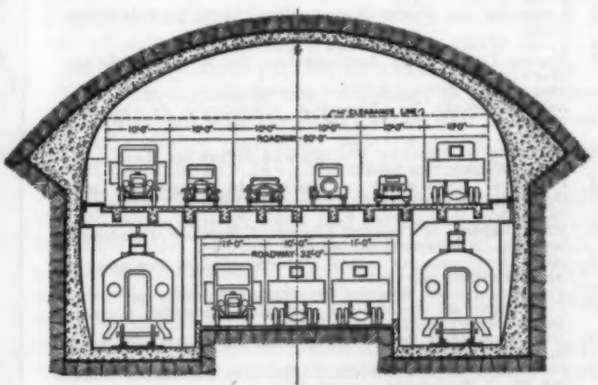
"It is expected that the fast moving water on approaching the outlet end of the concrete-lined channel will be deflected upward and literally pitched for a distance of 60 feet from the mouth of the channel. Much of its energy will be dissipated in this process and any erosive action will be at such a distance below the concrete work as not to undercut or endanger it."

This hydraulic jump is known locally as a "zoom."

The Transbay Bridge Tunnel

The San Francisco-Oakland Bay bridge presents many unusual features, due to the topographical and soil conditions. In fact, decision upon the general type, lengths of spans, kinds of foundations and other features of the design are governed by geological conditions, which are being determined by thousands of borings.

The bridge is in two sections, which are separated by Yuba Buena island, which is nearly 9,000 feet from the San Francisco shore. This island rises high above the grade of the bridge floor, and the line of the bridge will be carried through the island by tunnel, estimated to cost about a million dollars and having a larger cross-section than any traffic tunnel yet built.



Tunnel unit of San Francisco-Oakland Bay Bridge

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The rock through which the tunnel is to pass is badly faulted and broken, and a contract was let for diamond drill borings to thoroughly determine its character, the cost of the borings being $7,275.

Calcium Chloride Highway Patching

Acting upon the conviction that the motoring public is entitled to every precautionary measure that the highway department can provide, O. W. Merrell, Ohio highway director, has asked the engineers of the twelve highway divisions throughout the state to make a summary of projects which, although of a more or less minor nature, nevertheless call for possible improvement in that they constitute potential traffic hazards.

"One bad stretch of road or a hazardous small bridge or culvert can be the source of tremendous trouble for the motorist," Merrell pointed out. "Such highway defects are what we are interested in eliminating for the safety of those using the state highway system."

In conformity with this thought for the motorist's safety and convenience, a new type of pavement for use as a temporary riding surface has been introduced by the highway department in southeastern Ohio for economical maintenance of the state highway system where landslides cause damage to the roadway.

Maintenance of a good riding surface over sections of highways where landslides occur has long been a pressing problem of the highway department. Frequently sections of roadway are broken by the movement of landslides, making necessary replacement of the damaged stretch with a temporary pavement until advisable to repave the stretch with the original type of pavement.

Maintenance engineers of Division No. 10, of which A. W. Sherwood is engineer, have solved the temporary pavement problem through perfection of a riding surface out of a modification of the "calcium chloride patch," heretofore recommended for patching pot-holes in bituminous and macadam pavements.

A Low-Cost Limestone Road in Mississippi

The Mississippi State Highway Department has been constructing sections of test roads in an effort to utilize to the fullest local materials. One of these research projects on Route 80 near Brandon, was recently described in Mississippi Highways, official magazine of the state highway department, by G. A. Draper, chief engineer.

A limestone ledge was cleared, drilled and shot with dynamite; the fragments hauled in trucks to a crusher set up near by, crushed and screened. The top strata of hard material provide a grade of stone suitable for any highway work. The lower strata are softer, but excellent for base material.

The base of the test section consists of 6 inches of crushed material not screened, spread by hand and machined to a smooth and even surface. This is wet and rolled, and then while traffic uses it is kept as wet as possible, and freqently rerolled, the result being that it packs down into a very dense smooth, white surface.

Do you make full use of the Readers' Service Dept.?—see pp. 47-50

After compaction and drying, a prime coat of tar or asphalt is applied, followed by a seal coat with 3/8 to 1-inch chips of hard stone. This procedure builds up a smooth, dustless, non-skid surface. The cost is but little more than that of a gravel road, while furnishing all the desired characteristics of a road suitable for the traffic of that section.

Low cost of construction, the utilization of local materials and employment of labor are combined in such construction to provide a satisfactory, safe and smooth-riding road.

Bidders on Ohio Highway Projects Must Prequalify

Pursuant to provisions of the highway contractors' pre-qualification bill passed during the recent session of the Ohio legislature and signed by Governor George White, Highway Director O. W. Merrell has sent out questionnaires covering confidential financial statements and experience to be filled in and submitted to the department.

The statements will give the status of the contractors as of July 1, 1933, and must be returned immediately to the highway department by all contractors desiring to bid on state work. Such statements will be filed and maintained on a strict confidential basis, and under no circumstances will be made public.

The pre-qualification bill empowers the director of highways to "require all bidders to furnish him under oath upon such printed forms as he may prescribe, detailed information with respect to their financial resources, equipment, past record, personnel of organization and experience, together with such other information as the director may deem necessary for the purpose of carrying out the provisions of this act."

The director of highways, according to the provisions of the bill, is not authorized to consider any bid filed with him by any person who has not been qualified under the terms of the act.

Non-Ohio corporations in the contracting business must furnish a certificate from the Secretary of State of Ohio citing that the corporation has qualified to do business in Ohio.

Army Preventive for Poison Oak

The following outline of a method to prevent poisoning by poison oak has been issued by the headquarters of the Ninth Corps Area, U. S. A., San Francisco. It is said to have been used successfully by engineering students of the University of California while on excursions into the field.

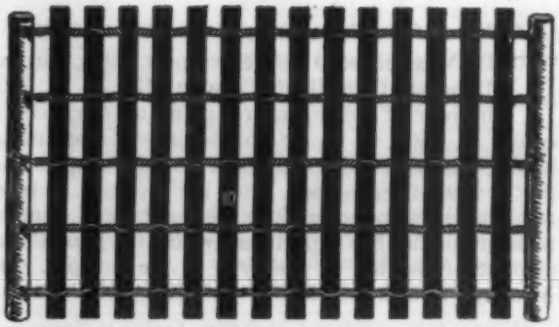
"First bathe all exposed parts in 10 per cent ammonia water—that is hands, arms, face, neck and ears. When applying to the face hold your breath while you put it on and wipe it off with a towel.

"Then apply liberally to the same area a saturate solution of hyposulphite of soda. Allow this to dry on the skin without wiping. This solution is nothing more or less than the ordinary "hypo" used in developing photographs. It forms a very thin but tough and resilient coating on the skin which prevents the fine oil from the poison oak plant from penetrating into the pores.

"Once infected with poison oak all the remedies on the market are worthless except for relief."

[Editorial comment: As compared to a daily bath with ammonia and hypo, we personally prefer to take chances with the obnoxious weed. Why not learn what it looks like and let it alone?]

Mattson Snow Fence



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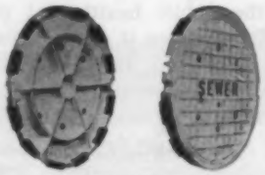

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Legal Decisions for Engineer and Constructor

By John Simpson

Order of Council Requiring Competitive Bidding

THE Massachusetts Supreme Court holds, Burt v. Municipal Council of Taunton, 172 N. E. 230, an order of the council requiring all contracts in excess of $500 to be let to the lowest responsible bidder was within the competency of the council and that a vote of the council, after the rejection of bids, referring back to a committee the purchase of a motor pumper for the fire department without regard to the amount of the bid or the type of the pumper, was invalid, while the order was in force.

Time for Filing Claims Against City Applies to Contracts

The contractor for the construction of a cement culvert for a city assigned its interest in the contract to a bank, which filed the assignment with the city clerk. The contractor completed the work and received a warrant for its claim therefor, which was cashed through the bank. About two years thereafter the bank claimed this amount from the city under the assignment. It was held, First Nat. Bank v. City of Whittier, (Cal. App.), 292 Pac. 661, that an ordinance of the city providing that claims against it must be filed within a year after the last item accrued was applicable to contractual obligations, and judgment for defendant was directed.

Specifications Valid Though Not Prescribing Time

Specifications which give such precise and full information to prospective bidders as the nature of the contemplated work permits, and furnish the same information to all prospective bidders, so that there may be intelligent bidding, are sufficient. Specifications which do not require the proposed work to be done within any particular time, but impliedly within a reasonable time, are not unlawful as permitting each bidder to set the length of time within which to complete the contract. All bidders are treated alike in this respect. Phifer v. City of Bayonne, New Jersey Supreme Court, 146 Atl. 463.

Pollution of State Waters by Sewage

The Rhode Island Supreme Court holds, Board of Purification of Waters v. Town of Bristol, 153 Atl. 879, that an order of the plaintiff board requiring the town to adopt a sewage system to prevent the pollution of public waters was not unlawful. The statute creating the board, with authority to regulate or prohibit the pollution of the waters of the state, is operative throughout the state with the exception of Newport and Jamestown. The statute is held a valid exercise of the police power of the state for the protection of the public health and public welfare. It is not invalid because it did not extend over the entire area of the state. It is held that the expense is not a sufficient objection to justify the town's refusal to take action.

Damages for Breach of Contract for Hauling

In an action for breach of a contract whereby plaintiff was to do the necessary hauling for the contractor for construction of sidewalks, testimony by plaintiff that he was to put on an additional truck at the end of the first week was held not prejudicial. Testimony as to his preparing a truck body for hauling, though irrelevant, did not warrant a new trial. The contract provision that the price per hour was based on the time of a one-ton truck did not limit the contract to one truck, and plaintiff's testimony that he was to be paid for two trucks after the first week was admissible. Pittman Const. Co. v. Ellis, Georgia Court of Appeals, 147 S. E. 420.

Extras Ordered Verbally

Orders for extras verbally given by the defendant general contractor's superintendents to plaintiff subcontractor for the installation of sewer and drain pipes, such extras being mainly for additional depth of trenches, made to enable the subcontractor to do his work in accordance with the requirements of the defendant's general contract with the county, were held binding and recoverable, although the contract provided that there should be no allowances for extras unless authorized in writing. The authority of the superintendents to order the extras was held not only inherent in their positions, but it was also recognized and confirmed by the payment of the subcontractor's invoices, in the early stages, for work on the contract price and for the extras ordered by the superintendent. Causte v. Board, etc. of Essex County et al. New Jersey Court of Chancery, 152 Atl. 640.

Liability of State for Result of Blasting Done by Highway Contractor

A railroad company sued the state of Washington for damages caused to its right of way and track by blasting done under the direction and supervision of the state highway engineer or his authorized representative, as contemplated by the plans and specifications under which the work of highway construction was done. The railroad track was located along the shore at the base of a mountain, and on account of the steepness of the bluff, it was necessary to blast out a shelf for the highway, and dump the material on the hillside and the railroad track below. This caused slides, obstructed the track and did the damage for which compensation was sought. The Washington Supreme Court, Spokane, Portland & Seattle Ry. Co. v. State, 230 Pac. 231, affirmed judgment for the plaintiff, holding that the state was to be regarded as the superior, and responsible as such, although it did the work by contract and by the direction of its duly authorized officers, if the acts which caused the injury were done under and in consequence of the direction of the state. The case was held controlled by the decision in Great Northern Ry. Co. v. State, 102 Wash. 348, where a railroad track was obstructed by material blasted from a mountain side for a shelf for a highway. It was held that under Wash. Const., art. 1, § 16, forbidding the taking of private property without just compensation, the state is liable if in building a state highway without negligence, the railroad's property not having been condemned in advance, it was necessary to blast out and dump rock and material on the track to its damage. As in the Great Northern case, there was no question of negligence in the present case.

New Equipment in Pictures

Koehring Dumptor on highway work

New Koehring Dumptor:

The new Koehring wheel dumptor has increased body capacity, as well as a reinforced body to make it able to stand up under heavy rock work without damage. The gasoline tank has been raised to give greater ground clearance. The driver's seat design has been improved facilitating driving either forward or backward without inconvenience to the driver. The illustration shows Dumptors on highway grading, in which work they have proven exceptionally successful and economical.

Storm King Signal Torch

The Shanklin Mfg. Co., Springfield, Ill.,, has announced a new torch, the Storm King, which is said to have a number of advantages. Among these are listed a new easy on-and-off cap, which wi'l not leak; an automatic carbon dispenser which guarantees a good clear flame right to the last drop of kerosene; a flame guard and wick holder all in one which will not get lost; a big handle, like the old lantern, to carry it with; a corrugated double strength cover, and a non-tipping feature, so that it always comes back to an even keel. It is guaranteed, the makers say, to burn through the toughest wind and rain storms.

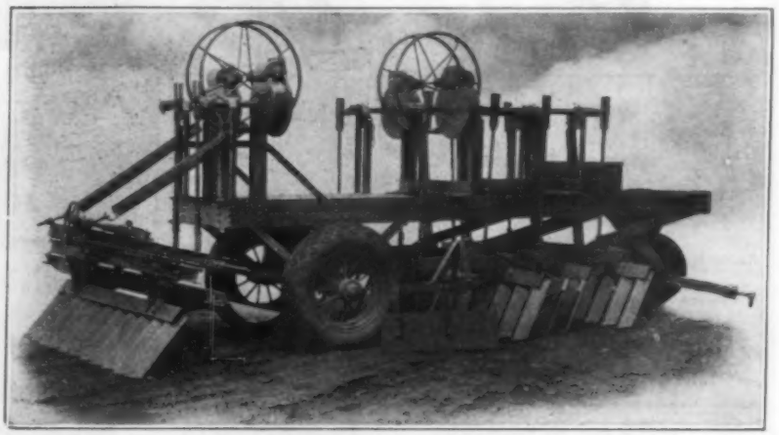
Features of the Storm King Torch

For Mixed-in-Place

Here is something that the manufacturers say will save about 40% in mixed-in-place work as compared to the general method of blading and windrowing. They further say "it does not involve a large capital investment." It is designed to accomplish rapid and thorough mixing—two important steps.

The Parsons Mfg. Co., Newton, Ia., are the manufacturers, and the data below are furnished by them. It can be operated by a 50 or 60 hp tractor and one man, and in one passage over the road turns the material five times. It will handle material up to 8 inches in depth. It follows the distributor, securing the first mixing while the material is still hot. This quick action is especially desirable if emulsion is used.

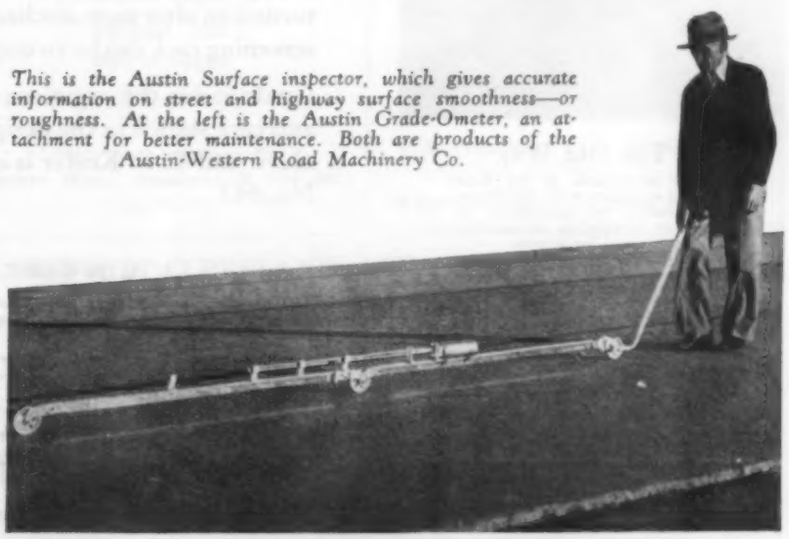
The vanes are made of very durable alloy steel. The vanes are easily and exactly adjustable and are equipped with springs. The rear unit is equipped with both blade and vanes. A trimmer with adjustment is attached to the right side to prevent scattering of material and run-off to the sides. It weighs 8,000 pounds and works a strip 8½ feet wide.



A new and promising piece of equipment by Parsons for mixed-in-place work

We haven't seen this equipment operate as yet, but hope that we shall be able to do so in the near future. It should act to further popularize that cheap and excellent surface, the mixed-in-place.

This is the Austin Surface inspector, which gives accurate information on street and highway surface smoothness—or roughness. At the left is the Austin Grade-Ometer, an attachment for better maintenance. Both are products of the Austin-Western Road Machinery Co.



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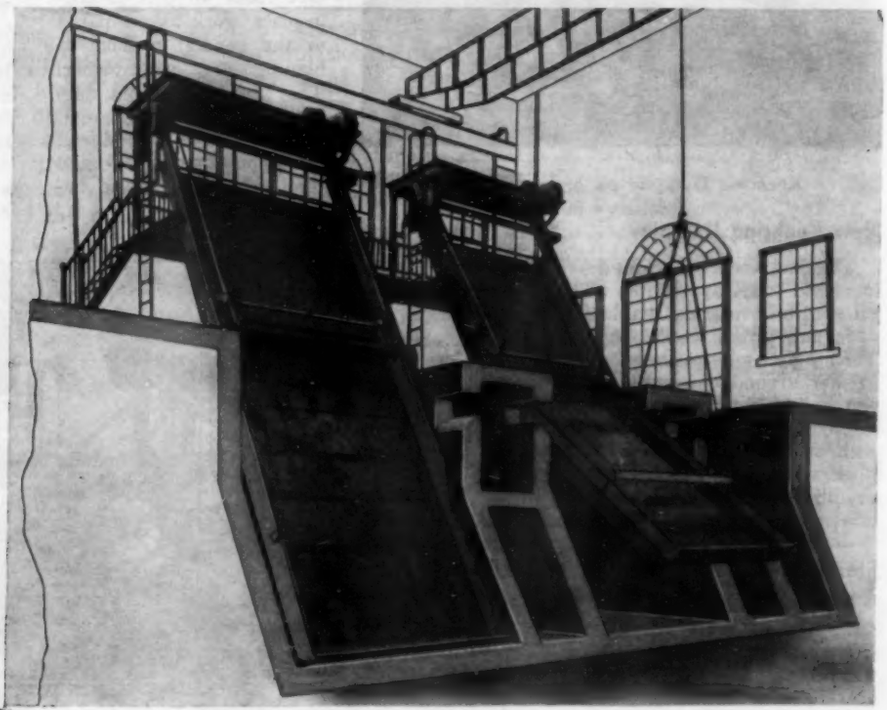

The Old Way

Actual photograph of the hand cleaning operation at the Baltimore plant before the installation of Link-Belt Straightline mechanically cleaned bar screens.

GOOD appearance and utility were combined in the design of this new screening installation at Baltimore's Back River Disposal Plant. The two STRAIGHTLINE mechanically cleaned screens illustrated, have replaced the old fashioned hand method of doing this unpleasant job.

These dependable units assure constant, automatic removal of screenings, which are discharged direct into a shredder, macerated and returned to the sewage. The shredder chute and dead plate are washed with water jets which are automatically turned on after each discharge. By means of a gantry crane, the screening rack can be swung clear of the sewage for inspection.

Credit is due the engineers of the Sewerage Dept. for the skill and care shown in the design of this plant. George E. Finck is chief, and C. E. Keefer is in charge of design. Send for Book No. 642.

4804

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Ready for the New Deal

Infilco Rate of Flow Controllers

International Filter Co. CD Rate of Flow controllers are designed for any water-works or industrial plant requirement where automatic maintenance of a uniform rate of flow of fluid is desirable or necessary for efficient operation.

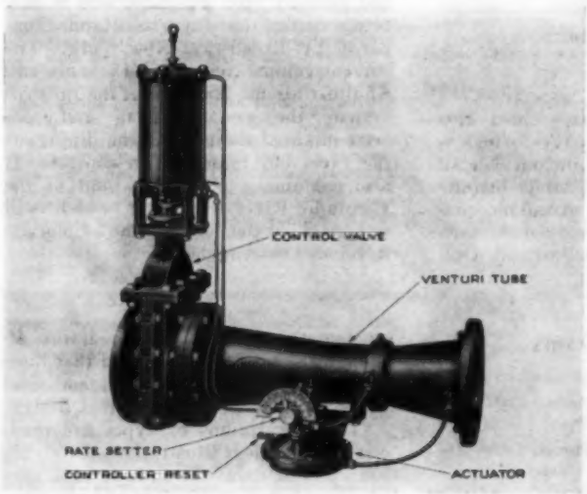
Operating rates for the Type CD Controller are changed simply by turning a knob and moving a pointer to the rate indicated on a calibrated dial.

The type CD controllers are provided with a reset to automatically close the control valve when flow through the line is shut off. Thus when flow begins the controller regulates "up to" rather than "down to" the set rate, and the normal opperating rate cannot be exceeded even momentarily while the shut-off valve is being opened.

The type CD wash water controller is equipped with a patented automatic feature that automatically prevents waste as well as dangerous wash rates.

These controllers are shipped completely assembled, and installation merely consists of setting the controller in the line and making pressure and waste connections to the control pilot.

Write International Filter Co., 59 East Van Buren Street, Chicago, Illinois, for their 16-page illustrated Bulletin No. 67 describing the constant differential type rate of flow controllers.



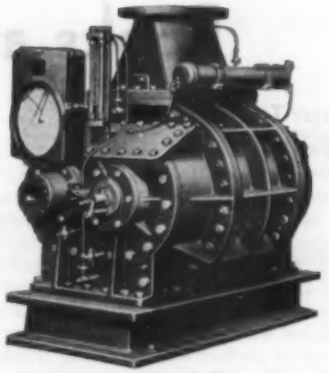
Above: Ecolite electric lantern. Left: The Infilco rate controller.

An Electric Lantern:

The Ecolite safety lantern is a spark-proof, safe, lantern that can be used in any place where the requirements demand such equipment. This lantern was tested in 17 different percentages of gaseous vapors, both for ignition from switch and for brakage, and was found safe. It is said to be very economical in operation. It is made by the Economy Electric Lantern Co., 325 West Huron St., Chicago, Ill. It is approved by the Underwriters Laboratories for all hazardous ues. A couple of them might be handy around every sewage treatment plant, and to go into sewers with, without danger of blowing up the community.

Connersville Rotary Displacement Meters:

These meters are adapted for the measurement of gas from the digesters of sewage treatment plants, as well as for industrial uses. They are accurate and retain that accuracy, even over a range of 10% to 150% of normal rating. Because of variations in temperature and pressure, it is desirable to equip such meters with a pressure, volume, temperature and time recording gauge. The illustration herewith shows a high-pressure meter with recorder attached.



Connersville Sewage Gas Meter

It is becoming most desirable to equip digesters at sewage treatment plants with apparatus, and this equipment, manufactured by Roots-Connersville-Wilbraham, Connersville, Ind., is very well adapted to such installations. Bulletin 40B10 is available for designers who wish more information.

A New Line of Marion Excavators

The Marion Steam Shovel Company, Marion, Ohio, is adding to its line a complete series of clutch type fully convertible excavators. These are the straight friction fully convertible type consisting of a primary power unit, either gas, Diesel, or a single electric motor connected through a master clutch and speed reducing mechanism, directly to the main machinery. Thus, the various functions of hoisting, traveling, swinging, crowding and booming are independently controlled through friction clutches.

A decided advantage of these new Marions lies in the ease and speed with which they can be changed over from shovel to dragline, crane, clamshell or trench shovel, or vice versa.

LEFT: *A Littleford 900-gallon street flusher with an aluminum tank, owned by the city of Cincinnati.* CENTER: *New Lufkin rule.* RIGHT: *One of the new Marion excavators.*

Books and Booklets

Water Treating:

D. W. Haering & Company, Inc., 3408 Monroe Street, Chicago, Ill., announce publication of a 16-page booklet on Water Treating. This booklet describes the application of H-O-H treatments to various water problems and explains in detail the cause and effect of many problems common to boiler and hot water equipment. The booklet, which is packed with practical information and scientific data of value to the plant engineer, chemist and maintenance man, will be sent free on request.

Universal Cast Iron Pipe:

A new 56-page booklet featuring Universal Cast Iron Pipe and fittings has been issued by Central Foundry Co., 420 Lexington Ave., New York. This is an abridged catalog with many interesting pictures of installations. Universal joints are fully described. Copies free from Henry Hoeltge, 420 Lexington Ave., New York.

Side Suction Volute Pumps:

A new bulletin on Side Suction Volute Pumps has just been published by Morris Machine Works, who originated this type of pump. Various types of drive are illustrated, and complete rating tables are given for pumps driven by belt, motor and steam engine. The typical performance curves included in the bulletin show a non-overloading power characteristic and high efficiency over a wide range of capacity.

These Morris Pumps are built in sizes from 1 to 20-in. for capacities up to 14,000 g.p.m. at heads up to 120 ft., and are suitable for handling clear water and abrasive or pulpy mixtures. They have many applications in industrial plants and for general pumping or unwatering service.

This new bulletin will be of special interest to plant engineers and contractors, and copies may be obtained by addressing Morris Machine Works, Baldwinsville, New York.

Armco Crib Retaining Walls

This booklet is devoted mainly to showing the various places where metal cribbing has been and can be used advantageously—as wing walls and abutments on bridges and grade separations, for culvert wing walls or for raising headwalls on large culverts for widening roads and streets where right-of-way is limited, for track elevation work in cities, for grade separations where parallel streets, roads or tracks are close together but at different elevations, for stabilizing slopes, for use across ravines where natural slopes would require excessive fills, for preventing encroachment of streams and for many other purposes.

Armco Metal Cribbing forms a gravity retaining wall in which earth resists earth. The two main units, known as the "headers" and "stretchers," are shown in detail, as well as pictures illustrating how they are connected together to form a continuous wall that is completely strong and stable at all points. A wall as high as 30 ft. is shown.

Among the many advantages listed are: Great strength, minimum excavation, no massive footings, rapid erection by unskilled workmen, long service assured by Armco Ingot Iron, adaptability to change or extension, 100 per cent salvage value and low installation cost. Copies on request.

Cement Bound Macadam Maintenance Costs

The Portland Cement Association, 33 W. Grand, Chicago, has issued this 8½ x 11 booklet of 15 pages, which is available on request. It includes detail summaries and charts of street maintenance for cement bound macadam, concrete and other types of pavement, covering the last 15 years in Portland, Ore.

In the decade 1908 to 1918 Portland built over a million square yards of cement bound macadam which sturdy, low-cost type of pavement is in the midst of a remarkable revival. All of the Oregon city's yardage is still in service, running in age from 15 to 25 years—an average of 21 years. From 1918 to date detail maintenance records were kept and tabulated.

The average yearly maintenance cost of the entire yardage of cement bound macadam, equivalent to 93 miles of 18-foot pavement, for the last 15 years is shown by the record to have been 3 mills per square yard of $32 per mile.

Third Hoover Dam Booklet

Volume 3 in a series of booklets, "The Story of the Hoover (Boulder) Dam," had recently been published and is now being mailed by Ingersoll-Rand Company, 11 Broadway, New York. The current volume consists of 48 pages and 67 illustrations. It describes the railroad system, the gravel-treating and concrete-mixing plants, and the lining of the diversion tunnels with concrete. It also contains a general account of the Colorado River Aqueduct which will transport water from the Colorado River to Los Angeles.

Design of Dams

By W. A. Hardenbergh and Samuel Baker. 115 pp., 37 illus. Published by International Textbook Co.

Reviewed by Calvin V. Davis, Chief Designer Ambursen Dam Co.

This little book is a timely contribution to the subject of dam design. Although of an elementary nature the text is thoroughly up to date and embodies the fundamental concepts of modern dam design.

This treatise will be of value to the student of engineering, for whom it was primarily intended, as well as to the practicing engineer who may wish to acquire a knowledge of the basic principles of dam design. There are few municipal engineers who have the time or inclination to master the intricate and complicated designing procedures that accompany the advanced phases of this subject and for this reason the actual design of dams is now largely entrusted to consulting engineers specializing in this work. A broad knowledge of the fundamental theory of dam design, however, may be invaluable to the municipal or public works engineer if he is called to pass upon the plans or the construction of such work. It is in furnishing such information clearly and concisely that this book fills a very definite need.

The contents of the text are confined largely to such important basic subjects as descriptions of types, the investigation of the site, the forces acting on dams and the fundamental theories for the proportioning of dams. The authors have properly avoided a detailed treatment of many of the complex problems that are encountered in modern dam design although the reader is cautioned that these are often of major importance and must be given consideration in actual design.

The descriptions of types are made clear by excellent illustrations. In giving examples of dams the authors have very wisely selected those of recent construction embodying the most modern design practice. The authors have also covered certain improvements in type such as the round head, the massive buttress and the improved multiple arch dam.

Each step of the theory of design is accompanied by clear illustrative examples. This is particularly important to the student approaching this subject for the first time as it is only through the solution of such problems that sound judgment in the proportioning of dams may be acquired.

These illustrative examples cover the complete design of the gravity dam. Conservative practices are recommended for such uncertain forces as ice pressure, earth pressure and uplift. These are most important as many failures have resulted from designers either underestimating or ignoring these forces.

In the case of the arch dam and the buttress dam only illustrative computations are given for the preliminary proportioning of the structure. This is proper as the final design of such structure is a long and tedious process that is entirely outside the scope of this book.

The final sections of this book deal with dam appurtenances and cover such matters as spillways, flashboards, tainter gates, undersluices, etc. As in other parts of the book these descriptions are made clear by the use of excellent illustrations.

Readers' Service Department

To help you in your work, any of this **INDUSTRIAL LITERATURE** will be sent **FREE** upon request.

IT is a good practice to check this list regularly because descriptions of new bulletins are always being added. ★

Construction Materials and Equipment

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Mixing Plants

10. Precise engineering control of bituminous pavement construction is provided at low initial cost by the new Blaw-Knox (Madsen) portable asphalt mixing plant which is described and illustrated in a new catalog just issued by Blaw-Knox Company, 2019 Farmers Bank Building, Pittsburgh, Pa.

Asphalt Plants

11. A very complete 24 page booklet covering all five sizes and types of Iroquois Asphalt Mixing Plants which are particularly adapted to meet the needs of municipalities and contractors, providing maximum output at minimum cost. Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 20 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Culverts

60. "In diameters up to 10 feet and larger . . ." just issued by the Armco Culvert Mfrs. Assn., tells a good deal about drainage problems and their solution. 32 pages about drainage and multi-plate culverts.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders with hydraulic control is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., care of The Jeffrey Mfg. Co., Columbus, Ohio.

78. The No. 101 Austin Leaning Wheel Grader is completely described and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sloper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., No. A5, Chicago.

79. Four new bulletins have just been issued describing and illustrating the Austin No. 77 Motor Grader. Contain construction details, specifications and weights. The Austin-Western Road Mach. Co., 400 N. Michigan Ave., No. A5, Chicago, Ill.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the MacMillan Petroleum Corp., El Dorado, Arkansas.

114. Complete information concerning Alabama Asphaltic Limestone will be sent promptly on request to the Alabama Asphaltic Limestone Co., Liberty National Bldg., Birmingham, Ala.

Road Machinery

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., No. A5, Chicago.

9-33

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Road Machinery

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Rollers

132. A 32-page book in four colors featuring a complete line of road rollers. 8½ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses.

134. "The Chief," a six cylinder roller of advanced design and construction is fully described in an illustrated catalog just issued by the Galion Iron Works & Mfg. Co., care of The Jeffrey Mfg. Co., Columbus, Ohio. Gives complete details of the very latest development by this company.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3210 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ⅜ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., No. A5, Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines. 910 S. Mich. Ave.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Road and Street Maintenance

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Asphalt Mixing Plants

10. Precise engineering control of bituminous pavement construction is provided at low initial cost by the new Blaw-Knox (Madsen) portable asphalt mixing plant which is described and illustrated in a new catalog just issued by Blaw-Knox Company, 2019 Farmers Bank Building, Pittsburgh, Pa.

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Bituminous Material Handling

201. "Handling Bituminous Road Materials." This is a new and valuable booklet covering handling and heating of bituminous materials for low cost road construction and maintenance. Full data regarding Cleaver-Brooks equipment. Cleaver-Brooks Co., 740 North Plankinton Ave., Milwaukee, Wis.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Surface Heaters

220. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

113. Complete and detailed specification sheets on Road Oil and Penetration Asphalts, furnished on request by the Macmillan Petroleum Corp., El Dorado, Arkansas.

226. Full details concerning the uses and advantages of Lincolnite Pulverized Petroleum Asphalt, Linco Road Oils, Cutback Asphalt Cement and Penetration Asphalt Cements will be sent free on request by Lincoln Oil Refining Co., Box 251, Robinson, Ill.

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

229A. Surface Treatment Types, Asphalt Road Construction Manual No. 2. Full details on surface treatments. 14 chapters, 128 pages. The second of those tremendously valuable and handy little manuals put out by the Asphalt Institute, 801 Second Avenue, N. Y. Sent on request.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

Jacking Culverts

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

SWEET'S STEEL POSTS

Available in ten standard lengths varying from 5 to 9½ feet in length and in four standard weights.

No separate parts are required to attach fencing—adaptable to any type of wire fencing.

SWEET'S STEEL COMPANY *Write for Descriptive folder.* **Williamsport, Pennsylvania**

Engineering News Items

Coming Conventions and Conferences:

The Missouri Water and Sewerage Conference will hold its ninth annual meeting at Jefferson City, Mo., September 22 and 23. Herbert Bosch, State Board of Health, Jefferson City, Mo., is secretary of the conference. The Missouri Public Health Association will also meet at the same place at the same time.

The Michigan Conference on Water Purification will hold its meeting at Grand Rapids September 19 and 20, immediately preceding the meeting of the Central States Section of the AWWA. John M. Hepler, State Department of Health, Lansing, Mich., is secretary.

The Pennsylvania Water Works Operators' Association will meet at State College, Pa., September 7, 8 and 9, coincident with and following the meeting of the Pennsylvania Sewage Works Association, notice of which was published last month. I. M. Glace, State Board of Health, Harrisburg, is secretary.

The Conference of State Sanitary Engineers and the meeting of the Public Health Engineering Section of the APHA will be held at Indianapolis, Ind., October 9 to 12. A long and interesting program has been prepared. Information regarding these meetings can be obtained from the American Public Health Association, 450 7th Ave., N. Y., and R. E. Tarbett, the Public Health Service, Washington, D. C.

The New England Water Works Association will hold its 52nd annual meeting at the Hotel Stratfield, Bridgeport, Conn., September 19 to 22. Frank J. Gifford, Tremont Temple, Boston, Mass., is secretary.

National Bituminous Pavers

Leading asphalt pavement producers have formed the National Bituminous Pavers' Industrial Association which, as a representation of this field will stand behind the efforts to stimulate industrial recovery. Thirteen regional administrators have been appointed. E. Sutcliffe is president; W. P. McDonald and L. B. West are presidents; and Troy Carmichael, secretary. Regional directors are:

Region 1—New England States: E. Sutcliffe, Vice President, Warren Brothers Company, Boston.

Region 2 — New York — Pennsylvania District: Wm. P. McDonald, President, Wm. P. McDonald Co., New York & Lakeland, Florida.

Region 3—Central Western States: George R. Cooke, President, George R. Cooke Asphalt Paving Company, Detroit.

Region 4 — Middle Western States: Gilbert W. Haggart, President, Haggart Construction Company, Fargo, N. D.

Region 5—Northwest States: Troy Carmichael, Northwest Road Co., Portland.

Region 6—California District: Arthur F. Brough, President, Southern California Roads Co., Los Angeles.

Region 7—Southwestern States: Louis S. Lang, Craven & Lang, Inc., New Orleans, La.

Region 8—Corn Belt States: Daniel J. Boone, Vice President, Webb-Boone Company, St. Louis, Mo.

Region 9 — South Atlantic States: George B. Carey, President, Carey-Reed Company, Birmingham, Alabama.

Region 10—Southern States: Larry B. West, President, West Construction Company, Chattanooga, Tenn.

Region 11—District of Columbia and insular possessions: A. G. Rolfe, McGuire & Rolfe, Washington, D. C.

Personal News and Items:

Frank T. Sheets, until recently chief highway engineer of Illinois, has been appointed consulting engineer of the Portland Cement Association.

Albert Moyer has been elected president of the Vulcanite Portland Cement Co., New York, succeeding the late W. D. Lober.

I. W. Mendelsohn, formerly a sanitary engineer of the United States Public Health Service, has just returned from a trip around the world, in the course of which he visited many sanitary engineering installations.

Catalogs and Bulletins

Four new bulletins on air compressors, 120 to 360 cubic feet capacity, have been issued by Worthington Pump and Machinery Corp., Harrison, N. J. Copies can be obtained from F. A. Pope of this company.

Paving breakers, sheeting drivers, bolt drivers, and clay and trench diggers are fully described in a new 24-page bulletin issued by Gardner-Denver Co., Quincy, Ill. This company has also issued a folder on a new lightweight hand held drill.

Long-Life Pavements gives some exceedingly interesting data on service life and service costs of pavements built with native lake asphalt. Copies of this can be obtained from W. F. Hartzell, Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.

Air blowers, their uses, capacities, speeds and pressures are contained in a booklet issued by Roots-Connersville-Wilbraham, Connersville, Ind., which describes the Victor-Acme line of blowers for pressures up to seven pounds.

Belt Idlers, their dimensions and lists, are given in Bulletin 569, issued by the Jeffery Mfg. Co., Columbus, Ohio.

Low Cost Highway Surfaces with Calcium Chloride is a valuable contribution to low cost highway literature. Four pages, issued by the Calcium Chloride Assn., Ray Giddings, Sec'y, 4200 Penobscot Bldg., Detroit, Mich.

Pittsburgh Testing Laboratory has issued Bulletin No. 1 announcing the organization of a welding division to render complete service for manufacturers, fabricators, contractors and engineers.

Highway Equipment, including tool heaters, surface heaters, reheating pans, construction kettles, squeegee carts and tools and pots, as made by Littleford Bros., Cincinnati, O., are described in Bulletin I-3. Worth having in your files. We're glad to send it on request.

Latest Developments in Pipe-Welding

How to cut welding time in half on any kind of piping job—how to make stronger joints with less outlay for welding rods and gases—how to design, lay out, construct, erect and maintain a welded piping system—these are some of the subjects that you will find of interest in "Fabrication of Oxwelded Piping," a new 160-page book published by The Linde Air Products Company, New York, and offered without charge to readers of this magazine.

Step-by-step procedures for oxy-acetylene welding steel, cast iron, copper, brass and lead piping and for making fittings right on the job contribute to the usefulness of this book, in which 75 illustrations and 20 ready-reference tables explain every problem connected with the welding of building and industrial piping.

Other features are chapters on testing and qualifying welders for pipe work; on inspection methods while pipe welding is in progress; on methods of testing welded joints, and on estimating costs.

Sectional Plate Pipe:

A 32-page handbook with data and illustrations of a recently developed sectional plate pipe of large diameter has been issued by Toncan Culvert Mfrs. Ass'n, Youngstown, Ohio, from whom copies can be obtained. This new pipe is especially fitted for heavy duty drainage installations.

U. S. Civil Service Again

After a long absence from the field, the U. S. Civil Service announces examinations for Engineer, Assistant, Associate and Senior engineer, in all branches of engineering, including civil and highway. These positions pay $2,600 to $5,400, less the 15% deduction and one or two other small reductions. Applications must be on file at the U. S. Civil Service Commission, Washington, D. C., not later than Sept. 28. Rating will be on education and experience.

Sanitary Engineer

33 years of age, married, college graduate, 12 years experience in design of sewage treatment plants, including reports and supervision, in charge of work for the last four years.

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Index to Advertisements

Allen & Vagtborg	43
Alvord, Burdick & Howson	43
Ambursen, Constr. Co.	43
Armco Culvert Mfrrs. Assn.	3
Atlas Mineral Prod. Co.	34
Babcock Brothers	43
Barrett Co., The	Front Cover & 35
Barstow & McCurdy	43
Black & Veatch	43
Browne, Floyd G.	43
Buffalo-Springfield Roller Co.	37
Burns & McDonnell Eng. Co.	43
Caird, James M.	43
Chamberlin Hotel	38
Cleveland, H. Burdett	43
Cramer, Robert	43
Dow, A. W.	43
Elrod, Henry E.	43
Filtration Equipment Co.	32
Flanders Hotel	37
Frink, Mfr., Carl	51
Fuller & Everett	43
Fuller & McClintock	43
General Motors Truck Co.	8
Green Co., Howard R.	44
Harrub Engineering Co., C.N.	44
Hill, Nicholas S., Jr.	44
Hitchings & Co.	44
Innis-Speiden & Co.	29
Jaeger Machine Co.	34
Link-Belt Co.	42
Littleford Bros.	37
Lord & Burnham	34
Mathieson Alkali Works, Inc.	2
Mattson Wire & Mfg. Co.	39
Metcalf & Eddy	44
Mohawk Asphalt Heater Co.	39
Municipal Sanitary Ser. Corp.	29
Nye Odorless Incinerator Co.	33
Pacific Flush Tank Co.	31
Paulette & Wilson Engr. Co.	44
Pearse, Greely & Hansen	44
Pennsylvania Salt Mfg. Co.	6
Piccadilly Hotel	31
Pirnie, Malcolm	44
Potter, Alexander	44
Quinn Wire & Iron Works	35
Roberts Filter Mfg. Co.	31
Shevlin Engineering Co.	33
Simplex Valve & Meter Co.	33
South Bend Foundry Co.	34
Standard Oil Co. (Ind.)	4 & 5
Standard Oil Co. of N. Y.	38
Sterling Engine Co.	31
Sweets Steel Co.	48
Taylor, Henry W.	44
Wallace & Tiernan Co.	Back Cover
West Steel Casting Co.	39
Wiedeman & Singleton	44

Snow Removal

Snow Fences

344. "Control Winter Drifts"—A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Peoria, Ill. Illustrated in two colors.

345. "Standard and Heavy Duty Reversible Blade Snow Plows for Motor Trucks," a new bulletin just published by the Monarch Mfg. Co., East Front St., Wilmington, Del. Illustrated. Contains complete descriptions and specifications.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activated Carbon, Aqua NUCHAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 400 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

381. Proportioneer's Inc., 737 N. Michigan Ave., Chicago, describe in an 8 page folder their mechanical devices for controlling accurately and automatically the flow of fluids used for treatment of water supply and sewage. Ferr-O-Feeder —diaphragm pump for Ferric-Chloride or other corrosive fluids; Chlor-O-Feeder for Hypochlorate solutions. Write for a free copy.

Ferric Chloride

382. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

383. Loughlin Clarifying Tanks for the more complete removal of suspended solids from sewage and industrial wastes at lower cost are described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

Sludge Drying

385. Relatively dry cake sludge in demand for fertilizer is produced by automatic continuous vacuum filters like those used in Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C. Write for literature. Oliver United Filters Inc., 33 West 42nd St., New York, N. Y.

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill., are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Irvington, N. Y.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So Michigan Ave., Chicago, Ill.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Meters, Sewage and Water

405. Just issued. Every sanitary engineer should have a copy of this new 32 page booklet describing the applications, types and distinctive features of the new Bailey meters for sewage treatment and water supply. Sent promptly. Bailey Meter Co., 1027 Ivanhoe Road, Cleveland, Ohio.

Pipe Forms

407. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Screens, Sewage

417. The simple, automatic, Loughlin self-cleaning traveling screen is fully described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

420. A useful new bulletin for all those interested in sewage disposal, describing some of their proven equipment such as self-cleaning bar screens, grit conveyors, sludge collectors and shredders, has just been issued by the Jeffrey Mfg. Co., Columbus, Ohio. Includes diagrams and many illustrations.

Screens

424. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Conditioning

381. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

Treatment

429. A new series of bulletins describing their full line of sewage treatment equipment—Fine Screens, Schofield Bar Screens, Vacuum Filters for Sewage Sludge, Decarie Screenings Incinerators, Schofield Bar and Fine Screens, Vacuum Filters for Sewage Filtration and Pneumatic Ejectors for Sewage Screenings—are ready for distribution on request to Municipal Sanitary Service Corp., Room 2703, 155 East 44th St., New York, N. Y.

430. Separate bulletins showing their many lines of sewage treatment equipment will be sent promptly by The Pacific Flush Tank Co., Chicago and New York. The latest is No. 110 describing tray clarifiers.

431. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcomes these problems will be sent to all interested by Oliver United Filters Inc., 33 West 42nd St., New York, N. Y.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

FRINK SNO-PLOWS

Model 68 S Sno-Plows and Model 12 F H R Leveling Wings with full hydraulic control attached to 5-7 ton trucks.

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